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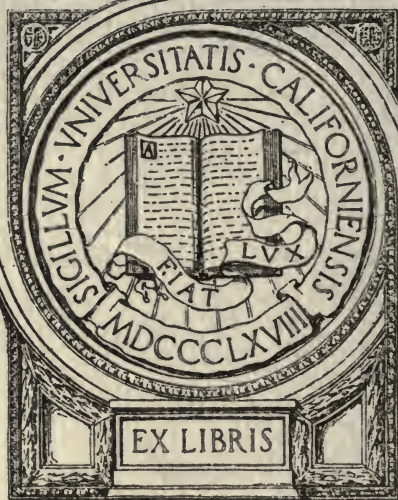


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# Heights and Weights of New York City Children

14 to 16 Years of Age

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A Study of Measurements of Boys and Girls  
Granted Employment Certificates

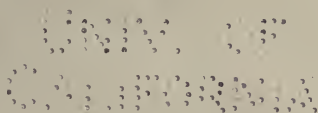
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BY

LEE K. FRANKEL, Ph.D., Sixth Vice-President

AND

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Metropolitan Life Insurance Company, New York

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# Heights and Weights of New York City Children 14 to 16 Years of Age\*

## A STUDY OF MEASUREMENTS OF BOYS AND GIRLS GRANTED EMPLOYMENT CERTIFICATES

The New York State Labor Law provides that no child between the ages of 14 and 16 shall be employed in a factory or in a mercantile or other specified establishment, unless he or she is in possession of an employment certificate. As a condition for granting this certificate, the law requires that the child shall have completed the work prescribed for the first six years of the elementary schools, and that in the opinion of the issuing officer the child shall have reached the normal development for his age. He must be in sound health, as determined by a thorough medical examination, and must be physically able to perform the work he intends to do. As the law in no way controls the nature of the work which the child may be called upon to do, except by prohibiting his employment in dangerous trades, it can readily be seen that the only construction of this law which will adequately protect the child is to determine his physical fitness for any work in which he may lawfully engage. This investigation has concerned itself in part with the determination of certain norms of physical development which may serve as a guide to those upon whom devolves the duty of issuing employment certificates.

Height and weight are obviously important factors in the examination to determine physical fitness, but emphatically so in the decision of the medical officer as to the normal development of each applicant. Hence, the chief object of this investi-

\*An abstract of this paper was read before the Eighth Congress of the American School Hygiene Association, San Francisco, June, 1915.

The authors desire to acknowledge their indebtedness to Miss J. V. Minor, Assistant Secretary of the New York Child Labor Committee, who suggested this study; to Dr. S. S. Goldwater, former Commissioner; to Dr. Haven Emerson, Commissioner; to Dr. S. Josephine Baker, Director of the Bureau of Child Hygiene, Department of Health of the City of New York; and to Mr. I. S. Adlerblum, of the Statistical Bureau, Metropolitan Life Insurance Company, under whose immediate direction the tabulations contained in this paper were made.



gation is to establish the normal height and weight of children between the ages of 14 and 16. The normal measurements for a given age can be arrived at only by a statistical study of a considerable number of cases. For this purpose, the Board of Health of New York City, at the request of the writers, turned over to them the records of the 10,043 children who had received certificates during the nine months beginning July 13, 1914, and ending April 12, 1915.

To be sure, a number of investigations have been made on the heights and weights of children. The subject received its impulse from the well-known anthropometric researches of Quetelet. In England, notable studies were made by Galton, Roberts, Greenwood and others. An early investigation of the subject in this country was made by Bowditch in 1877 in the city of Boston. Subsequent studies were made by Peckham in Milwaukee, Porter in St. Louis, Boas in Worcester, Oakland and Toronto, and by a number of other investigators. But these studies concerned themselves with children at school, while our data deal with children who are on the point of leaving school to go to work. Moreover, the number of children between the age limits of 14 and 16 covered in the other investigations was in every case comparatively small. Thus, Bowditch's data included only 2,678 children, and the investigations carried on in the other five cities combined were based on an aggregate of 5,514 children 14 to 16 years of age. Our study is based on a much larger number of observations, namely, on 10,043 children, and is, therefore, more representative for children at these ages.

The records of the Health Department were transcribed on cards, and the following information was abstracted in each case: sex, color, birthplace of child, birthplace of father, mother-tongue, age, height, weight, grade in school, and various other items pertaining to the condition of the applicant's health. The foregoing items were tabulated, either singly or in combination, to give the data of this investigation. We shall first dispose of a few preliminary items such as sex, age, and school grade of the children, and shall then proceed with the consideration of their height and weight.

#### SEX

Of the 10,043 children, 5,393, or 53.7%, were boys, and 4,650, or 46.3%, were girls. The preponderance of boys over

girls is found during each of the four half-years, as is shown in Table 1 below.

### AGE

Ages are stated in years and months, a fraction of a month being counted as a full month. For example, a child of age 14 years and 2 days at the time of examination, was put into the age-group 14 and 1 month. There were thus 24 age-groups of 1 month each, starting at age 14 years and 1 month, and ending at age 15 years and 12 months. These were re-arranged into quarter, half and full year age-groups.

The children were distributed by half-year age-periods as follows:

**TABLE 1**  
**Number and Percentage of New York Boys and Girls, Ages**  
**14 to 16, Granted Employment Certificates**  
**Classified by Half-year Age-periods**

AGE-PERIOD	BOYS		GIRLS	
	Number	Per cent. of Total	Number	Per cent. of Total
14 -16.....	5,393	100.0	4,650	100.0
14 -14½.....	2,002	37.1	1,624	34.9
14½-15.....	1,403	26.0	1,203	25.9
15 -15½.....	1,263	23.4	1,141	24.5
15½-16.....	725	13.4	682	14.7

The first half-year period contains the largest proportion of children. Each of the succeeding half-years shows a regularly diminishing number. It is perhaps noteworthy that the excess at the first age-period is more marked in boys than in girls, 37.1% of all the former being in the first half-year, as against 34.9% of the latter. In the second half-year the proportion of boys and of girls is about equal, 26.0% of the former and 25.9% of the latter. In the third and fourth half-years the ratio of girls to the total of their sex is higher than the corresponding figure for boys, compensating, of course, for the reverse relationship obtaining during the first year. Age 15 to 15½ includes 23.4% of the boys and 24.5% of the girls, and age 15½ to 16 embraces 13.4% of the boys and 14.7% of the girls.

### SCHOOL GRADE

Table 2 gives the distribution of the boys and girls by school grade for the two-year period.

**TABLE 2**  
**Number and Percentage of Boys and Girls, Ages 14 to 16**  
**Classified by School Grade**

SCHOOL GRADE	BOYS		GIRLS	
	Number	Per cent. of Total	Number	Per cent. of Total
All grades.....	5,393	100.0	4,650	100.0
7A.....	1,924	35.7	1,607	34.6
7B.....	629	11.7	586	12.6
8A.....	416	7.7	394	8.5
8B.....	467	8.7	297	6.4
Graduates.....	1,647	30.5	1,461	31.4
High School.....	287	5.3	287	6.2
Vocational.....	5	.1	1	
Unknown.....	18	.3	17	.4

In view of the requirements of the law demanding the completion of the sixth grade, it is not surprising to find that the children in Grade 7A contributed the largest number, 35.7% of the boys and 34.6% of the girls. The graduates formed 30.5% of the boys and 31.4% of the girls. These two groups together contributed approximately 66% for each sex. Only a small number of high school children are represented, namely, 5.3% of the boys and 6.2% of the girls. The remainder are distributed among the other school grades.

The above considerations show clearly the effect of the present law on the composition of the children who apply for work papers. The largest groups as to age were those in the first half-year period. From the distribution by grade, we find similarly that the minimum grade, 7A, contributed the largest number of children. In fact, 2,002 boys, distributed over the various grades, waited until they were just old enough, before applying for employment certificates. In addition, 1,924 boys who were eligible as to age were obliged to wait until they had reached the minimum grade. These two groups have 731 boys in common, that is, boys who have just satisfied the minimum requirements, both as to age and grade, before applying for certificates. Deducting these 731, who are common to the two groups, we obtain 3,195 out of a total of 5,393, or 59.2% of the boys who, lacking either in age or in school grade requirement, waited until they were just eligible under the law to apply for employment certificates. The corresponding figure for the girls is 56.2%. Whatever the cause of this condition may be, it is quite obvious that these children took advantage of the



privileges which were accorded them, under the law exempting them from school attendance, at their first opportunity.

### HEIGHT

Heights given in the Health Department records are for children in shoes, to the nearest quarter-inch. Comparative tests made by the examiners showed that the shoes gave an error in the net heights of from  $\frac{3}{4}$  to 1 inch for boys, and from  $1\frac{1}{2}$  to 2 inches for girls. In the following tabulations, heights are given in one-inch units, each including all values to the next unit; thus, 61 inches includes  $61\frac{1}{4}$ ,  $61\frac{1}{2}$  and  $61\frac{3}{4}$  inches.

The following table gives the distribution of the boys and girls for the two-year period, by heights in inches:

**TABLE 3**  
**Number and Percentage of Boys and Girls, Ages 14 to 16, at**  
**Each Inch of Height**  
**Also Average Heights, Standard Deviations and Quartile Heights.**

HEIGHT (Inches)	BOYS		GIRLS	
	Number	Per cent.	Number	Per cent.
54 and under.....	22	.4	18	.4
55.....	71	1.3	17	.4
56.....	129	2.4	76	1.6
57.....	250	4.6	152	3.3
58.....	384	7.1	357	7.7
59.....	470	8.7	542	11.7
60.....	641	11.9	822	17.7
61.....	650	12.1	781	16.8
62.....	666	12.3	694	14.9
63.....	605	11.2	512	11.0
64.....	527	9.8	322	6.9
65.....	389	7.2	180	3.9
66.....	263	5.0	107	2.3
67.....	155	2.9	47	1.0
68.....	76	1.4	14	.3
69 and over.....	90	1.7	9	.2
Total.....	5,393	100.0	4,650	100.0

	BOYS (Inches)	GIRLS (Inches)
Average height.....	61.99	61.35
Standard deviation ( $\sigma$ )....	$3.08 \pm .020$	$2.38 \pm .017$
First quartile.....	59.91	59.88
Second quartile (Median)...	61.99	61.31
Third quartile.....	64.17	62.93

The height class "54 and under" includes heights ranging down to 49 inches for boys, and down to 50 inches for girls; "69 and over" includes heights ranging up to 72 inches for boys and up to 71 inches for girls. The number of children at

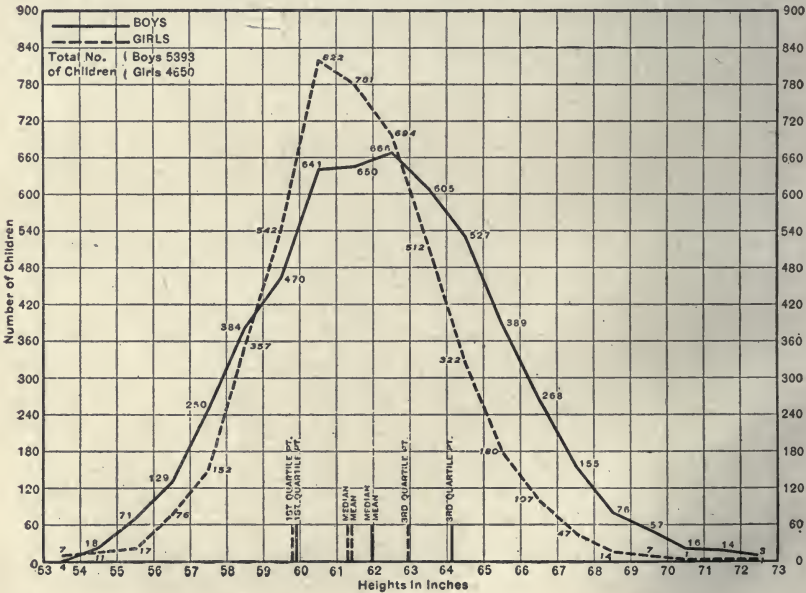
the extremes is small, as might be expected. The distribution follows quite closely the curve of error. It is fairly symmetrical, and the largest numbers cluster around the average. The mean and the median for boys are identical, both being 61.99 inches; in the case of girls, also, the figures agree quite closely, the mean being 61.35 inches, and the median only .04 inch less.

The distribution of heights between the first and third quartile points indicates that half of all the boys are found between the limits 59.91 and 64.17 inches, a range of 4.26 inches. Half of the girls, however, extend over a range of only 3.05 inches—between 59.88 and 62.93 inches. These figures show a greater variability in the height of boys as compared with that of girls. This is borne out further by the fact that the standard deviation, which is the measure of variability, is 3.08 inches for boys, and 2.38 inches for girls.

These facts are illustrated in Graph A, which portrays the distribution of the heights of the boys and girls for the two-

GRAPH A

Number of Boys and Girls, Ages 14 to 16, at Each Inch of Height; Also at Average, Median and Quartile Heights



year period. The solid line represents the boys, and the broken line the girls. The lesser variability of the girls is evident from the greater concentration of the cases about the mean. It is also interesting to note that the position of the first quartile point, that is, the height below which 25% of the cases are found, is almost identical for the two sexes; it is 59.91 inches for the boys, and 59.88 inches for the girls. On the other hand, the third quartile points, or the heights below which 75% of the cases are included, are more widely separated, being 64.17 inches for boys, and 62.93 inches for girls.

As has already been pointed out, the boys are taller than the girls, the averages being 61.99 and 61.35 inches respectively, or a difference of .64 inch. The actual difference between the average heights is even greater, because of the fact that the girls wear higher heels. Accurate figures are not available, but it is safe to say that an additional half-inch may be added to the above figure (.64 inch) to give the net difference in the average heights of the two sexes. This difference is somewhat greater than that found by other observers. The data of Bowditch,\* for example, give a net difference of .47 inch in favor of the boys for the two-year period, and those of Boas† give a difference of only .10 inch.

These sex comparisons are much more significant, however, when made for each of the two years, and not for the two years combined; for the height relations of the two sexes present important differences in the individual years. This leads us to a discussion of gain in height of boys and girls during the two years covered in our investigation. It must be emphasized that our study is an extensive and not an intensive one. Our data do not cover individual children, each studied at various stages of development. Each child, at whatever age, was under observation only once.

The following table gives the average heights for each of the eight quarter-year periods for the boys and girls:

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\*H. P. Bowditch, "The Growth of Children" (8th Annual Report of the State Board of Health of Massachusetts), Boston, 1877.

†Franz Boas, "The Growth of Toronto Children" (Report of the Commissioner of Education for 1896-7), Washington, 1898.

Boas and Wissler, "Statistics of Growth" based on a study of school children in Worcester, Mass. (Report of the Commissioner of Education for 1904), Washington, 1905.

Franz Boas, "Changes in Bodily Form of Descendants of Immigrants" (Vol. 38. Reports of the Immigration Commission), Washington, 1911.



TABLE 4

Number and Average Height of Boys and Girls for Ages 14 to 15  
and 15 to 16 and for Each Quarter-year.

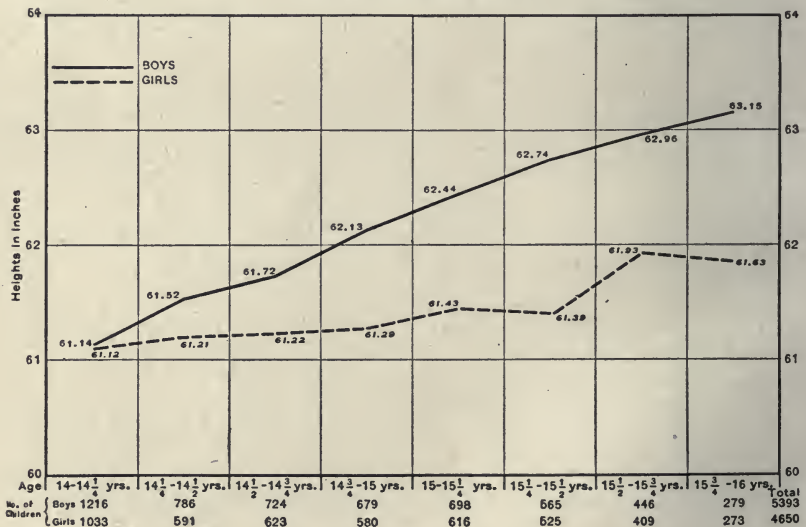
AGE- PERIOD AND SEX	WHOLE YEAR		FIRST QUARTER		SECOND QUARTER		THIRD QUARTER		FOURTH QUARTER	
	No. of Children	Average Height (Inches)	No. of Children	Average Height (Inches)	No. of Children	Average Height (Inches)	No. of Children	Average Height (Inches)	No. of Children	Average Height (Inches)
Age 14-15										
Boys	3,405	61.55	1,216	61.14	786	61.52	724	61.72	679	62.13
Girls	2,827	61.19	1,033	61.12	591	61.21	623	61.22	580	61.29
Age 15-16										
Boys	1,988	62.74	698	62.44	565	62.74	446	62.96	279	63.15
Girls	1,823	61.59	616	61.43	525	61.39	409	61.93	273	61.83

The facts of this table are presented in Graph B.

The solid line represents the boys and the broken line the girls. The heights of the boys increase regularly with age. This is evident from the fact that their line of growth is almost straight. Girls, on the other hand, remain almost constant in height during the first year. Thereafter, their height increases irregularly; the greatest height is reached in the seventh-

GRAPH B

Average Height of Boys and Girls, Ages 14 to 16, at each  
Quarter-year Period





quarter. In the two years under consideration, the boys increase 2.01 inches. The girls increase only .71 inch, although the range between minimum and maximum height of girls is .81 inch, which is attained in the seventh quarter. It may be seen that, although the height of girls is virtually stationary in the first of these two years, it increases nearly as much as that of the boys in the second year. These figures are in marked contrast to those of Boas, who found for Toronto children a difference of over 3.46 inches for boys, and of 1.69 inches for girls, from the first to the eighth quarters in these two years.

If we take the figures from year to year, instead of by quarter-years, we find a difference of 1.19 inches for boys between the 15th and 16th years; and for girls a difference of .40 inch. Bowditch found, among Boston children, increases of 2.42 and 1.16 inches for boys and girls, respectively. In like manner, Boas showed that the Toronto boys increased 2.40 inches, and the girls 1.07 inches, between the 15th and 16th years. The growth of the Boston and Toronto children in this period is, therefore, about twice that of the New York children. A number of factors may be cited in explanation of this condition: First may be mentioned the difference in the racial composition of the children in the several cities, there being a preponderance of Jewish and Italian children among those covered by the present investigation. Again, the New York children are a selected group, the taller and heavier being generally the first to leave school to apply for work papers. This results in the height at the beginning (age 14) being somewhat greater than that of the children who remained in school, and thus reduces the amount of gain in height in the period under observation. We shall meet with like differences when we take up other characteristics of the New York children.

#### WEIGHTS

The weights of these children were taken in ordinary clothing, to the nearest quarter-pound. Boys' jackets were not removed, but outer cloaks were removed. The Department of Health had no data on the average weight of the children's clothes. Bowditch, however, is authority for the statement that the average weight of the clothes of boys at 14 years is 8.09 pounds; of boys at 15 years, 8.08 pounds; of girls at 14 years, 7.54 pounds; and of girls at 15 years, 7.85

pounds.\* Table 5 gives the distribution of the children by weight in five-pound groups for the two-year period

TABLE 5  
Number and Percentage of Boys and Girls, Ages 14 to 16, for  
Each Five Pounds of Weight; Also Average  
Weights, Standard Deviations and  
Quartile Weights

WEIGHT (Pounds)	BOYS		GIRLS	
	Number	Per cent.	Number	Per cent.
65-69.....	3	0.06	1	0.02
70-74.....	15	0.28	7	0.15
75-79.....	182	3.37	80	1.72
80-84.....	396	7.34	227	4.88
85-89.....	394	7.31	330	7.10
90-94.....	522	9.68	480	10.32
95-99.....	601	11.14	624	13.42
100-104.....	622	11.53	655	14.09
105-109.....	554	10.27	566	12.17
110-114.....	551	10.22	506	10.88
115-119.....	476	8.83	417	8.97
120-124.....	391	7.25	269	5.78
125-129.....	237	4.39	178	3.83
130-134.....	165	3.06	113	2.43
135-139.....	102	1.89	69	1.48
140-144.....	58	1.08	36	0.77
145-149.....	52	0.96	20	0.43
150-154.....	23	0.43	23	0.49
155-159.....	19	0.35	8	0.17
160-164.....	7	0.13	12	0.26
165 and over.....	23	0.43	29	0.62
Total.....	5,393	100.00	4,650	100.00

	BOYS (Pounds)	GIRLS (Pounds)
Average weight.....	105.71	105.73
Standard deviation ( $\sigma$ ).....	17.25 $\pm$ .112	16.00 $\pm$ .112
First quartile.....	93.31	95.18
Second quartile (Median).....	104.57	104.27
Third quartile.....	117.03	115.01

For both boys and girls the lowest weight noted was in the group 65 to 69 pounds; the heaviest boy was over 205 pounds, the heaviest girl over 220 pounds. The distribution of weights, unlike the distribution of heights, is rather skew.

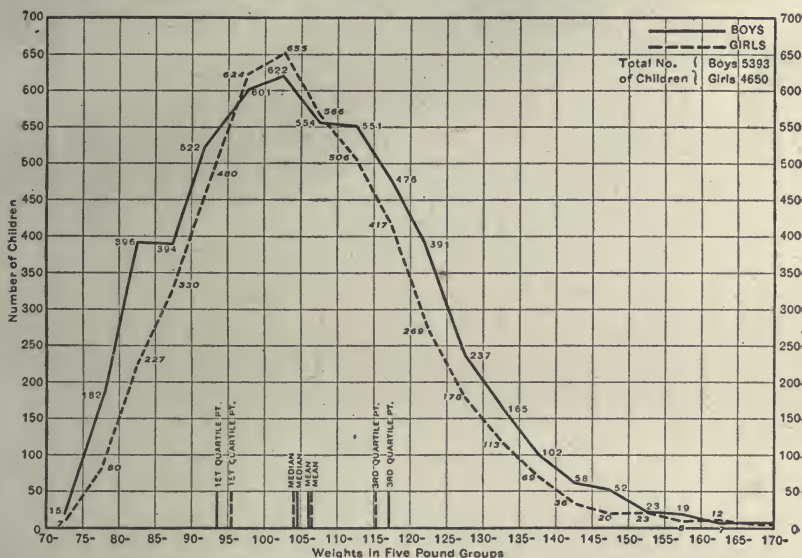
The average weight in each case is greater than the median. The average weight for boys for the two years under discussion is 105.71 pounds; the median, 104.57 pounds. The average for girls is 105.73, and the median 104.27 pounds.

\*The weights of the clothes of the children in the Hebrew Orphan Asylum are as follows: For boys at age fourteen, 6 pounds; at age fifteen, 6.75 pounds; for girls, at age fourteen, 4 pounds; and at age fifteen, 4.50 pounds.

Although the average weights of the boys and girls for the two-year period are nearly identical, being respectively 105.71 and 105.73 pounds, the boys show a greater amount of variation in weight than the girls. The standard deviation for the boys is 17.25 pounds, and for the girls 16.00 pounds. Moreover, the interquartile range—that is, the difference between the third and first quartiles—is 23.72 pounds for the boys, and only 19.83 pounds for the girls. Since one-half of the children are included within these limits, it is clear, as was the case with the heights, that the boys show a greater variability than the girls.

### GRAPH C

Number of Boys and Girls, Ages 14 to 16, for Each Five Pounds of Weight; Also at Average, Median and Quartile Weights



These facts are portrayed in Graph C. The girls cluster more closely about the average than the boys. It is interesting to note that the position of the first quartile point for boys is 93.31 pounds, which is considerably below the corresponding point for the girls, namely, 95.18 pounds. On the other hand, the third quartile point for boys is 117.03, as against 115.01 for girls. These differences are even more marked when we observe the relation of weights of boys to those of girls during the two individual years. This will incidentally show the amount of gain in weight of boys and girls during the year.



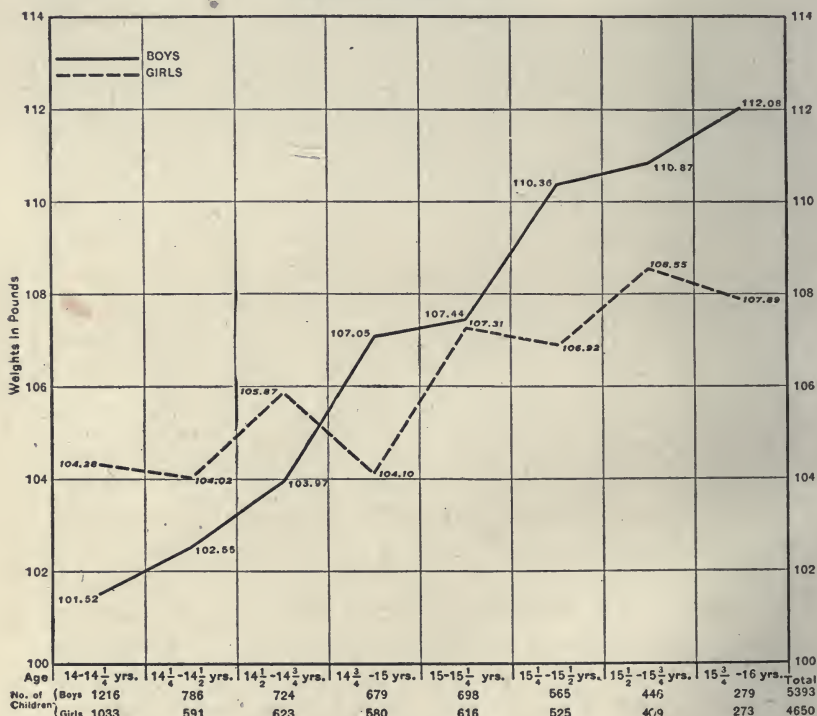
Table 6 gives average weights for each of the eight quarter-year periods and for each sex.

**TABLE 6**  
**Number and Average Weight of Boys and Girls for Ages 14 to 15**  
**and 15 to 16 and for Each Quarter-year**

AGE-PERIOD AND SEX	WHOLE YEAR		FIRST QUARTER		SECOND QUARTER		THIRD QUARTER		FOURTH QUARTER	
	No. of Children	Average Weight (Pounds)	No. of Children	Average Weight (Pounds)	No. of Children	Average Weight (Pounds)	No. of Children	Average Weight (Pounds)	No. of Children	Average Weight (Pounds)
Age 14-15										
Boys	3,405	103.38	1,216	101.52	786	102.55	724	103.97	679	107.05
Girls	2,827	104.54	1,033	104.28	591	104.02	623	105.87	580	104.10
Age 15-16										
Boys	1,988	109.69	698	107.44	565	110.36	446	110.87	279	112.08
Girls	1,823	107.57	616	107.31	525	106.92	409	108.55	273	107.89

Graph D exhibits the average weights for the successive quarter-year periods.

**GRAPH D**  
**Average Weight of Boys and Girls, Ages 14 to 16, at each**  
**Quarter-year Period**





The weight of the boys increases at a fairly steady rate. Starting with an average of 101.52 pounds in the first quarter, the weights increase regularly until in the last quarter of the 16th year they attain an average of 112.08 pounds. This is a gain of 10.56 pounds during the period. For the girls, on the other hand, the weights exhibit fluctuations from one period to another. There is, for instance, a sudden drop in weight from the third quarter to the following period. This condition has already been noted in the heights of the girls at the same ages. In the two years under consideration, the girls gain 3.61 pounds, or only about one-third as much as the boys gain. The girls in the seventh quarter show the greatest average weight, 108.55 pounds; those in the second quarter show the lowest average weight, 104.02 pounds. The girls are heavier than the boys in the first three quarters, but the boys surpass them in weight at every subsequent quarter.

In order to compare the growth in weight of the New York children with those reported upon by other investigators, it is necessary, as in the case of heights, to give the growth of our children during the period  $14\frac{1}{2}$  to  $15\frac{1}{2}$ . On this basis, the New York boys show an increase in weight from 103.38 pounds at  $14\frac{1}{2}$  to 109.69 at  $15\frac{1}{2}$ , or a gain of 6.31 pounds. The girls start at 104.54 pounds at  $14\frac{1}{2}$ , and increase to 107.57 pounds at  $15\frac{1}{2}$ , gaining 3.03 pounds. Bowditch's data show that the Boston boys gain 12.19 pounds and the girls 7.65 pounds. Boas found in the case of Worcester boys an increase of 15.6 pounds, and in the case of Worcester girls, an increase of 5.6 pounds, during the same period. Here, too, Boas' figures are more in harmony with Bowditch's than with ours. Our children show an increase in weight only one-half as large as the children of the other cities, a condition like that shown for heights, and explained in the same way.

#### RELATION OF WEIGHT TO HEIGHT

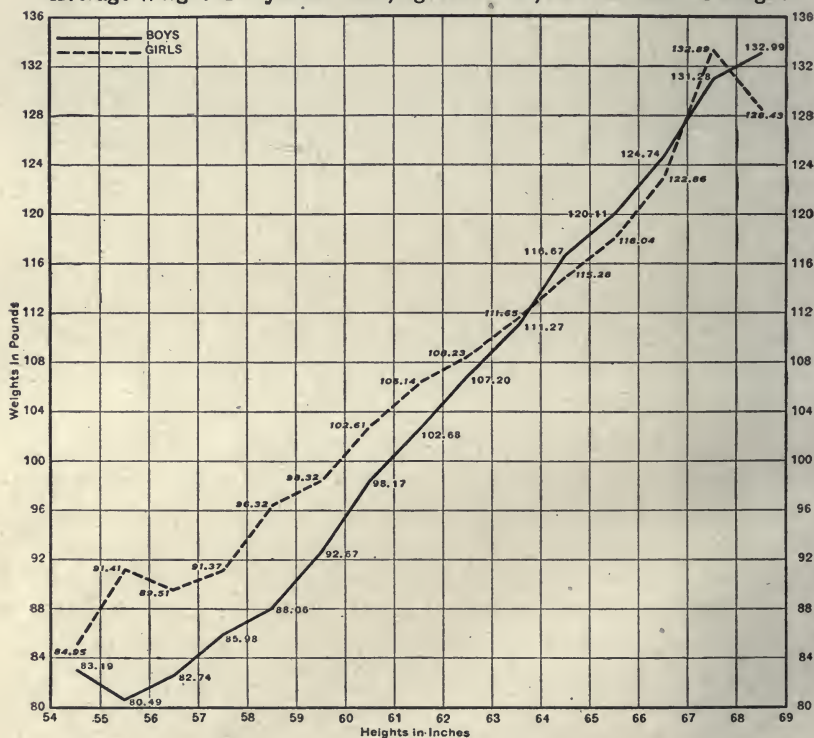
We have so far limited ourselves to a consideration of height and weight without reference to the relations that these two bear to each other. We shall now proceed to consider them in their related aspects, for weights, especially of growing children, are in large measure determined by height. Table 7 gives the average weights of boys and girls for each inch of height for the two-year period 14 to 16.\*

\*A more detailed presentation of the average weights for each half-inch of height at each quarter-year period is given in Table 19—Parts A-B—Appendix II.

**TABLE 7**  
**Number and Average Weights of Boys and Girls, Ages 14 to 16**  
**for Each Inch of Height**

HEIGHT (Inches)	BOYS		GIRLS	
	Number	Average Weight (Pounds)	Number	Average Weight (Pounds)
Under 54 .....	4	85.13	7	98.50
54.....	18	83.19	11	84.95
55.....	71	80.49	17	91.41
56.....	129	82.74	76	89.51
57.....	250	85.98	152	91.37
58.....	384	88.06	357	96.32
59.....	470	92.67	542	98.32
60.....	641	98.17	822	102.61
61.....	650	102.68	782	106.14
62.....	666	107.20	694	108.23
63.....	605	111.27	512	111.65
64.....	527	116.67	321	115.28
65.....	389	120.11	180	118.04
66.....	268	124.74	107	122.86
67.....	155	131.28	47	132.89
68.....	76	132.99	14	128.43
69 and over .....	90	139.15	9	136.06
Total.....	5,393	105.71	4,650	105.73

**GRAPH E**  
**Average Weight of Boys and Girls, Ages 14 to 16, for Each Inch of Height**



Graph E shows clearly the essential facts in this relation. Two points stand out:

1. Weight increases with height. The only exception is at the extremes of height in our series, where the number of cases is entirely too small to give a correct picture of the interrelation. Beginning with 55 inches among the boys and 56 inches among the girls, and continuing upward for the boys without exception, and for the girls to height 67 inches, the weights increase steadily with every successive inch of height. The actual increase in weight for every inch of height varies somewhat for the several heights, and also for the two sexes. In Table 8 (page 16) we give figures which present the relation of weight to height, smoothed so as to eliminate some of the fortuitous variations that make the lines in the graph rather irregular.

2. The girls are heavier than boys for any given height up to about 63 inches. Beyond this height, the boys outweigh the girls. The sole exception is the extreme upper limit of height, where the fewness of cases again mars the reliability of our data. This phenomenon is consistent with, although somewhat different from, the findings of other authors. Bowditch, for example, points out that girls are heavier than boys up to 58 inches. Above that point the reverse is true. He finds that the height of 58 inches is attained on the average in the 14th year. The fact that our figures cover the age-period of 14 to 16 only may in part explain the difference in the values of the crossing point in our investigation.

The above relations, which cover the two years combined, are, with but slight exceptions, true for each of the individual years. In the first year, namely, 14 to 15, the point where the boys overtake the girls is about 62.6 inches. In the next year it is approximately 63.4 inches.

As might be expected from the smaller number of cases in each individual year, the fluctuations in the weights for the successive inches of height are somewhat more marked than in the two-year period. It has therefore seemed desirable, in order to correct for the fluctuations resulting from the paucity of data, to "smooth" the series of weights. These figures are given in Table 8:



TABLE 8

**Number of Boys and Girls, and Actual and Smoothed Weights  
for Each Inch of Height, for the Years 14 to 15 and  
15 to 16**

HEIGHT (Inches)	BOYS						GIRLS					
	AGE 14 TO 15			AGE 15 TO 16			AGE 14 TO 15			AGE 15 TO 16		
	No. of Children	Actual Weight	Smoothed Weight	No. of Children	Actual Weight	Smoothed Weight	No. of Children	Actual Weight	Smoothed Weight	No. of Children	Actual Weight	Smoothed Weight
Under 54..	2	84.00	—	2	86.25	—	4	78.63	—	3	125.00	—
54.....	13	82.27	79.74	5	85.60	77.05	8	81.94	83.28	3	91.04	—
55.....	59	80.87	80.80	12	78.62	79.75	10	90.35	86.26	7	92.88	—
56.....	96	83.27	82.74	33	81.23	82.89	47	89.47	89.23	29	89.57	95.12
57.....	190	85.56	85.46	60	87.28	86.40	102	90.04	92.21	50	94.07	95.89
58.....	283	88.03	88.83	101	88.14	90.24	247	95.25	95.20	110	98.73	97.53
59.....	349	91.92	92.73	121	94.85	94.33	356	97.49	98.25	186	99.87	99.88
60.....	440	97.47	97.06	201	99.72	98.64	513	102.07	101.38	309	103.17	102.79
61.....	434	102.37	101.68	216	103.28	103.09	474	105.80	104.60	308	107.02	106.08
62.....	400	107.03	106.48	266	107.45	107.63	409	107.57	107.94	285	109.18	109.61
63.....	355	110.80	111.35	250	111.92	112.21	296	110.67	111.43	216	112.99	113.22
64.....	307	116.58	116.17	220	116.81	116.77	167	114.76	115.08	154	115.09	116.75
65.....	200	119.67	120.81	189	120.58	121.25	102	117.12	118.92	79	119.22	120.05
66.....	137	124.09	125.17	131	125.41	125.60	56	122.31	122.97	51	123.47	122.96
67.....	78	129.95	129.12	77	132.64	129.75	23	132.65	127.24	24	133.13	125.30
68.....	34	135.01	132.55	42	131.35	133.66	6	129.33	131.78	8	127.75	126.93
69 and over	28	137.86	—	62	139.73	—	7	144.29	—	2	107.25	—
Total	3,405	103.38	—	1,988	109.69	—	2,827	104.54	—	1,823	107.57	—

The "smoothed" values in this table will serve health officers and others as a more satisfactory standard than the actual averages, since the former are based on the assumption that the law which operates for the bulk of the material also holds good at the extremes.\* An examination of this table shows that with an increase of one inch in height, there is an increase in weight ranging from three to five pounds for each sex and for each year.

\*The "smoothed" series of average weights was obtained in the following manner: We denoted heights in inches by  $x$ , and weights in pounds by  $y$ . We then assumed that for each value of  $x$ , the proper value for  $y$  was obtained from the equation

$$y - 80 = a + b(x - 61) + c(x - 61)^2 + d(x - 61)^3$$

for certain values of the coefficients. The latter were evaluated by the method of "least squares." On this basis, we obtained the equations

$$y - 80 = 21.68 + 4.73(x - 61) + .09(x - 61)^2 - .02(x - 61)^3$$

$$y - 80 = 23.09 + 4.51(x - 61) + .05(x - 61)^2 - .01(x - 61)^3$$

$$y - 80 = 24.60 + 3.28(x - 61) + .06(x - 61)^2 + .004(x - 61)^3$$

$$y - 80 = 26.08 + 3.44(x - 61) + .12(x - 61)^2 - .03(x - 61)^3$$

giving, respectively, the relations of weight to height for boys 14 to 15 years, boys 15 to 16 years, girls 14 to 15 years, and girls 15 to 16 years.



The measure of the dependence of weight on height is given by the coefficient of correlation between the two. The following table gives the coefficients of correlation of weight with height for the two sexes, for each of the two years:

**TABLE 9**  
**Coefficients of Correlation of Height and Weight \***  
**Boys and Girls, Ages 14 to 15 and 15 to 16**

AGE-PERIOD	BOYS	GIRLS
14 to 15.....	.776±.0046	.499±.0095
15 to 16.....	.759±.0064	.439±.0128

These coefficients show that, within narrow limits, particular weights are associated with definite heights, and vice versa. The heights and weights increase and decrease together in close correspondence. This is particularly true for the boys, as is shown by the high correlation obtaining in their case. In regard to the girls the correlation is not so high, but is none the less significant; the coefficient in their case being at least as high as that found by Pearson for the inheritance from parent to child of physical characteristics. The lesser correlation for girls than for boys signifies that for any given height the girls range over a greater series of weights than do the boys. This will be seen more clearly in Table 16 (page 37) which contains the standard deviations from the average weights for each inch of height. This is an interesting phenomenon in view of the fact that, as we have seen, their total range of variation is smaller. It will also be noted from Table 9 that the correlations decrease with age in the case of both the boys and the girls.

The above coefficients of correlation are uniformly lower than those found by Boas in his study of the Worcester children. Thus, at the age 14 to 15, his figure is .87 for boys and .74 for girls. In agreement with Boas, on the other hand, is the fact that the coefficient of correlation for boys is greater than that for girls in each year, and also that there is a decrease in the value of the coefficient for each sex with an increase in

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\*These values are based on figures presented in detail in Table 20, Parts A-D, Appendix II.

age. The Boas figure for girls of age 15 to 16 is .57. This is not so much larger than the figure we find, namely, .44. An important factor to be considered in this comparison is the fact that the coefficients submitted by Professor Boas are computed uniformly on a small number of cases, and this accounts in some measure for the differences in the two sets of figures. It is also important to bear in mind that the coefficients of the New York children correlate height in shoes with weight in clothes. The heights, and presumably the weights, of the Worcester children were taken without shoes. The effect of this on the two sets of figures does not lend itself readily to calculation.

#### RELATION OF HEIGHT AND WEIGHT TO SCHOOL GRADE

Students of the growth of school children have found that there is a very high positive correlation between physical and intellectual development. Attention was directed to this fact especially by Porter in his study of St. Louis children. Confirmation was later given by Smedley for Chicago children, and by Boas for Worcester children. These authors have pointed out that in the advanced grades pupils are heavier and taller than the pupils of the same age in the lower grades. Conversely, children who are retarded in grade are also retarded in their physical measurements. Crampton, in his valuable monograph on physiological age, presents data for New York school children which clearly confirm these findings; his interpretation, however, is somewhat different, since he emphasizes pubescence as the determining factor which accounts not only for the advance in school grade, but also for the physical characteristics, such as height and weight. We are at present not concerned with the complications involved in a consideration of pubescence, since our material does not contain any facts with reference to this condition. These findings add interest, however, to the results obtained in our investigation. The following table gives the number of boys and girls, and their average height and weight in each of the school grades, at the half-year periods.

**TABLE 10**  
**Number and Percentage and Average Height and Weight of**  
**New York Boys and Girls, Ages 14 to 16**  
**Classified by School Grade and Half-year Age-periods**

AGE AND GRADE	BOYS				GIRLS			
	No. of Children	Per-centage	Average Height (Inches)	Average Weight (Pounds)	No. of Children	Per-centage	Average Height (Inches)	Average Weight (Pounds)
<b>14 to 16 yrs.</b>								
All grades...	5,393	100.0	61.99	105.71	4,650	100.0	61.36	105.79
7A.....	1,924	35.7	61.92	105.88	1,607	34.6	61.10	105.60
7B.....	629	11.7	61.51	103.56	586	12.6	61.27	105.22
8A.....	416	7.7	62.17	106.64	394	8.5	61.49	106.25
8B.....	467	8.7	62.16	107.14	297	6.4	61.77	106.21
Graduates...	1,647	30.5	62.10	105.58	1,461	31.4	61.45	105.68
High School...	287	5.3	62.40	106.77	287	6.2	61.72	107.94
Vocational...	5	.1	63.95	112.70	1	—	61.00	103.50
Unknown...	18	.3	59.64	97.22	17	.4	62.07	99.48
<b>14 to 14½ yrs.</b>								
All grades...	2,002	100.0	61.29	101.93	1,623	100.0	61.15	104.25
7A.....	731	36.5	61.33	102.22	615	37.9	60.82	103.80
7B.....	274	13.7	61.08	102.39	267	16.5	61.16	103.99
8A.....	170	8.5	61.59	103.32	159	9.8	61.24	104.88
8B.....	151	7.5	61.18	101.16	94	5.8	61.56	104.29
Graduates...	593	29.6	61.34	101.41	405	25.0	61.47	104.46
High School...	76	3.8	61.10	100.93	80	4.9	61.33	106.36
Vocational...	—	—	—	—	—	—	—	—
Unknown...	7	.3	58.33	91.07	3	.2	62.83	101.17
<b>14½ to 15 yrs.</b>								
All grades...	1,403	100.0	61.92	105.46	1,203	100.0	61.25	105.03
7A.....	515	36.7	62.02	106.63	435	36.2	61.02	105.54
7B.....	159	11.3	61.34	102.61	141	11.7	61.36	104.06
8A.....	101	7.2	61.90	105.57	99	8.2	61.59	107.30
8B.....	126	9.0	62.05	107.17	76	6.3	61.79	103.55
Graduates...	412	29.4	61.94	104.60	390	32.4	61.27	104.41
High School...	86	6.1	62.12	105.19	59	4.9	61.33	105.86
Vocational...	—	—	—	—	—	—	—	—
Unknown...	4	.3	62.31	106.38	3	.2	60.92	103.83
<b>15 to 15½ yrs.</b>								
All grades...	1,263	100.0	62.58	108.75	1,141	100.0	61.41	107.13
7A.....	445	35.2	62.38	108.56	362	31.7	61.34	107.20
7B.....	138	10.9	62.10	104.72	105	9.2	60.97	105.93
8A.....	102	8.1	62.96	110.24	88	7.7	61.77	107.15
8B.....	120	9.5	62.98	112.64	76	6.7	61.86	107.68
Graduates...	373	29.5	62.68	108.54	407	35.7	61.23	106.51
High School...	76	6.0	63.12	110.74	96	8.4	62.17	110.69
Vocational...	2	.2	67.00	118.50	1	.1	61.00	103.50
Unknown...	7	.6	59.43	98.15	6	.5	62.54	102.83
<b>15½ to 16 yrs.</b>								
All grades...	725	100.0	63.03	111.33	683	100.0	61.98	108.58
7A.....	233	32.1	62.71	110.56	195	28.6	61.71	108.44
7B.....	58	8.0	62.61	108.96	73	10.7	61.92	110.93
8A.....	43	5.9	63.27	113.73	48	7.0	61.61	107.01
8B.....	70	9.7	63.09	110.53	51	7.5	61.98	111.50
Graduates...	269	37.1	63.23	112.17	259	37.9	62.05	108.18
High School...	49	6.8	63.80	112.46	52	7.6	61.92	107.67
Vocational...	3	.4	61.92	108.83	—	—	—	—
Unknown...	—	—	—	—	5	.7	61.50	86.75



With reference to height, it is seen from Table 10 that the boys in grade 7A are invariably taller than those in the next higher grade. This is true in each one of the age-periods. This condition is directly opposed to the findings of the other investigators. On the other hand, boys show increasing heights from grade 7B through 8B for the two age-periods  $14\frac{1}{2}$  to 15, and 15 to  $15\frac{1}{2}$ . The graduates are taller than the 7A boys in every half-year except the second. Similarly, with the exception of the first half-year, the high school boys are taller than the 7A boys. When we consider the two-year period as a whole, the high school boys are markedly taller than the boys in 7A.

The girls present a lesser departure than the boys, from what we should expect on the basis of other investigations. In the first and second half-years there is a definite increase in height from grade 7A to 8B. In the third half-year this condition is limited to grades 7B, 8A and 8B. Graduates are taller than the 7A's in the first, second and fourth half-years. The high school girls are taller than the 7A's in every half-year. For the two years combined, girls show a steady increase in height from grade 7A to grade 8B. The graduates and high school girls are shorter than the 8B girls, but markedly taller than those in grade 7A.

The relations of weight to school grade are slightly different. For the boys the weights increase in the second and third half-years for grades 7B, 8A and 8B. In the first half-year the weights of boys increase from grade 7A to 8A, while the weights of 8B, graduate, and high school children fall below those for grade 7A. In the second half-year, the 7A boys are heavier than those in all the other grades, except 8B. The graduates and high school boys are lighter than the boys in 7A in the first and second half-years. In the third half-year the 7A boys are slightly heavier than the graduates, but lighter than the high school boys. In the fourth half-year both the graduates and the high school boys outweigh those in 7A.

The girls in the first half-year show an increase in weight for grades 7A, 7B and 8A. Graduates are heavier than 7A children, and the high school girls even more so. In the second half-year the weights fluctuate from grade to grade, the 7A children being heavier than the others, except for grade 8A and high school girls. In the third half-year the weight increases for grades 7B, 8A and 8B. Here the 7A children are



heavier than the graduates, but lighter than the high school students. In the fourth half-year, the weights fluctuate again, the graduates and high school children weighing less than those of 7A. For the two-year period as a whole, high school girls are considerably heavier than the girls in any of the lower grades.

While our results agree in the main with those of previous observers there are nevertheless striking exceptions which would suggest extreme caution in inferring a positive correlation between height and weight and school grade in children receiving employment certificates. The direct relations are neither as marked nor as constant as found by other observers. It would, therefore, seem that the children in our investigation have certain special characteristics which mark them as a selected group, rather than as a fair sample of New York boys and girls in the age-period 14 to 16. It should be remembered that the boys and girls under discussion do not represent school children in general, but only those who were on the point of leaving school to go to work. The various figures appear to show that children of better physique go to work at the earliest opportunity. This will explain the anomaly that our children of 7A are so frequently taller and heavier than those in the next higher grades. The more delicate children are apparently allowed to continue their schooling for longer periods before being sent to work. This fact is responsible for the variations from the findings of other observers.

#### NATIONALITY

Thus far, our principal concern has been with the children as a group. Our data, however, permit us to inquire also to some extent into the differences in the physical development of our boys and girls which may be attributed to their several nationalities. This is especially interesting in view of the many racial groups composing the population of New York City, and the important and perplexing questions that constantly arise in the adjustment of these races to American conditions.

It has not been possible in this study to classify the material rigidly on the basis of nationality or race stock. Instead, the racial terminology, which we have used as a matter of con-

venience, actually combines the mother-tongue and nativity classification. Our first group includes the native-born of native parentage. Contrasted with this first group are the native and foreign born of foreign parentage. This second group has been further subdivided into a number of race stocks as far as was possible. Under the classification "Jews" are included all native and foreign born children of foreign parentage whose mother-tongue was given as Yiddish. In like manner, "Italians" includes those whose fathers were born in Italy and whose mother-tongue was Italian. The designation "English, Scotch and Irish" covers children whose fathers were born in the British Isles and whose mother-tongue was given as either English or Scotch. "Germans" includes those whose fathers were born in Germany or Austria and whose mother-tongue was given as German. "Slavs" are those whose mother-tongue is given as Russian, Polish or Slavic. The last group, "Other Nationalities", includes all the residual cases.

The following table indicates the distribution of the boys and girls by nationality:

**TABLE 11**  
**Number and Percentage of Boys and Girls, Classified**  
**by Nationality or Race Stock**

NATIONALITY OR RACE STOCK	BOTH SEXES		BOYS		GIRLS	
	Number	Per cent. of Total	Number	Per cent. of Total	Number	Per cent. of Total
All nationalities or race stocks.....	10,043	100.0	5,393	100.0	4,650	100.0
Native-born of native parentage...	1,616	16.1	927	17.2	689	14.8
Jews.....	3,671	36.6	1,938	35.9	1,733	37.3
Italians.....	1,842	18.3	877	16.3	965	20.8
English, Scotch and Irish.....	1,099	10.9	670	12.4	429	9.2
Germans.....	954	9.5	510	9.5	444	9.5
Slavs.....	282	2.8	146	2.7	136	2.9
Other nationalities.....	579	5.8	325	6.0	254	5.5

The Jews compose the largest group with 36.6% of the total for both sexes. Since this race group constitutes at best only 20% of the population of New York City, it is evident that this race contributes not far from twice its quota to the boys

and girls who go to work at the earliest ages. Their nearest competitors are the Italians, but they are only half as numerous, forming 18.3% of the total. The native-born of native parentage form the third group with 16.1% of the total. They are followed by the British, the Germans and the Slavs in the order named.

The sex distribution, although brought out in the foregoing table, is indicated more clearly below. Table 12 indicates the percentage of each sex among the children of the various nationalities

**TABLE 12**  
**Percentage of Boys and Girls in Each**  
**Nationality or Race Stock**

NATIONALITY OR RACE STOCK	BOYS Per cent.	GIRLS Per cent.
All nationalities or race stocks.....	53.7	46.3
Native-born of native parentage.....	57.4	42.6
Jews.....	52.8	47.2
Italians.....	47.6	52.4
English, Scotch and Irish.....	61.0	39.0
Germans.....	53.5	46.5
Slavs.....	51.8	48.2
Other nationalities.....	56.1	43.9

The English, Scotch and Irish evidently send the highest proportion of boys to work; they show 61.0% of boys, and only 39.0% of girls. Next come the native-born of native parentage, of whom 57.4% are boys. Germans, Jews and Slavs then follow each other in succession. In no case does the proportion of boys vary greatly from the average, which is 53.7%. It is only among Italians that we find the relationship reversed, so that the girls are in the majority, constituting 52.4% of the total number of applicants.

Table 13 indicates the average height and weight by nationality, and by half-year age-periods:

TABLE 13

# Number and Average Height and Weight of New York Boys and Girls, Ages 14 to 16

Classified by Nationality or Race Stock and by Half-year Age-periods

NATIONALITY OR RACE STOCK AND HALF-YEAR AGE-PERIOD	BOYS			GIRLS		
	No. of Children	Average Height in Inches	Average Weight in Pounds	No. of Children	Average Height in Inches	Average Weight in Pounds
ALL NATIONALITIES OR RACE STOCKS:						
Age: 14 to 14½ yrs.....	2,002	61.29	101.93	1,624	61.15	104.19
14½ to 15 yrs.....	1,403	61.92	105.46	1,203	61.25	105.03
15 to 15½ yrs.....	1,263	62.58	108.75	1,141	61.41	107.13
15½ to 16 yrs.....	725	63.03	111.33	682	61.89	108.29
Total—14 to 16 yrs..	5,393	61.99	105.71	4,650	61.35	105.73
NATIVE-BORN OF NATIVE PARENTAGE:						
Age: 14 to 14½ yrs.....	332	61.42	100.79	223	62.13	104.36
14½ to 15 yrs.....	236	61.94	103.87	170	62.56	106.92
15 to 15½ yrs.....	235	63.14	109.76	172	62.38	108.38
15½ to 16 yrs.....	124	63.79	114.00	124	62.57	109.15
Total—14 to 16 yrs..	927	62.31	105.61	689	62.38	106.86
NATIVE-BORN OF FOREIGN PAR- ENTAGE AND FOREIGN-BORN:						
JEWS:						
Age: 14 to 14½ yrs.....	686	61.35	104.04	525	60.87	105.05
14½ to 15 yrs.....	526	61.85	106.28	461	60.86	105.57
15 to 15½ yrs.....	461	62.31	108.84	464	60.86	107.44
15½ to 16 yrs.....	265	62.87	112.28	283	61.28	108.21
Total—14 to 16 yrs..	1,938	61.92	106.92	1,733	60.93	106.34
ITALIANS:						
Age: 14 to 14½ yrs.....	340	60.50	100.28	427	60.15	103.20
14½ to 15 yrs.....	222	61.52	107.26	258	60.33	103.21
15 to 15½ yrs.....	208	61.59	106.95	189	60.32	104.03
15½ to 16 yrs.....	107	61.85	108.34	91	60.90	106.35
Total—14 to 16 yrs..	877	61.18	104.61	965	60.30	103.66



TABLE 13—(Continued)

# Number and Average Height and Weight of New York Boys and Girls, Ages 14 to 16

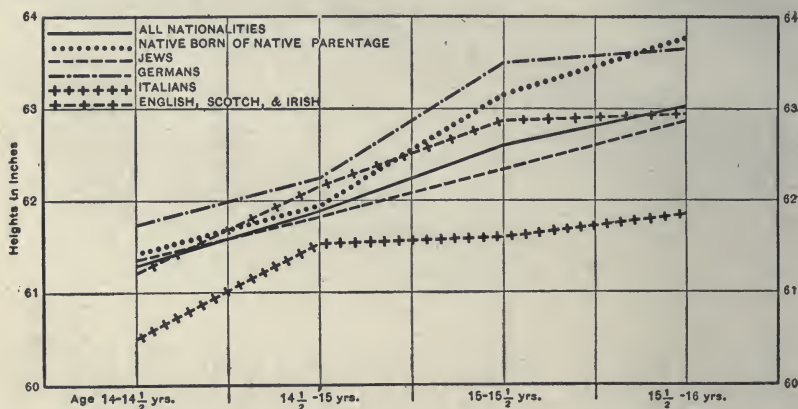
Classified by Nationality or Race Stock and by Half-year Age-periods

NATIONALITY OR RACE STOCK AND HALF-YEAR AGE-PERIOD	BOYS			GIRLS		
	No. of Children	Average Height in Inches	Average Weight in Pounds	No. of Children	Average Height in Inches	Average Weight in Pounds
NATIVE-BORN OF FOREIGN PARENTAGE AND FOREIGN-BORN: (Continued.)						
ENGLISH, SCOTCH and IRISH:						
Age: 14 to 14½ yrs.....	256	61.20	98.83	124	61.67	100.95
14½ to 15 yrs.....	158	62.15	102.83	101	62.04	103.67
15 to 15½ yrs.....	151	62.88	105.78	128	62.35	106.27
15½ to 16 yrs.....	105	62.94	105.85	76	63.06	107.55
Total—14 to 16 yrs..	670	62.07	102.44	429	62.21	104.35
GERMANS:						
Age: 14 to 14½ yrs.....	199	61.71	101.96	170	62.35	106.86
14½ to 15 yrs.....	136	62.26	105.58	125	61.90	106.98
15 to 15½ yrs.....	108	63.50	112.71	95	62.63	109.97
15½ to 16 yrs.....	67	63.66	112.77	54	63.19	112.47
Total—14 to 16 yrs..	510	62.49	106.62	444	62.39	108.24
RUSSIANS, POLES and BOHEMIANS:						
Age: 14 to 14½ yrs.....	61	61.98	104.81	71	61.78	101.40
14½ to 15 yrs.....	40	62.10	104.45	28	61.46	101.66
15 to 15½ yrs.....	27	63.87	113.30	25	62.44	110.67
15½ to 16 yrs.....	18	64.18	119.81	12	62.15	103.75
Total—14 to 16 yrs..	146	62.63	108.13	136	61.87	103.37
OTHER NATIONALITIES:						
Age: 14 to 14½ yrs.....	128	61.89	102.71	84	61.61	105.14
14½ to 15 yrs.....	85	62.33	105.30	60	61.85	103.13
15 to 15½ yrs.....	73	62.77	108.67	68	61.88	106.93
15½ to 16 yrs.....	39	63.65	113.04	42	62.30	107.69
Total—14 to 16 yrs..	325	62.42	105.97	254	61.85	105.57

Graph F shows the comparative heights of boys of various nationalities at each half-year period. The Russians, Poles and Bohemians are not plotted on the graph, because the small number of children represented by these race stocks mars the validity of any comparison with the others.

## GRAPH F

Average Heights of Boys of Various Nationalities at Each Half-year Period, Ages 14 to 16



The German boys are tallest, with an average stature of 62.49 inches for the two years combined. Next come the American boys, with an average of 62.31, and the English, Scotch and Irish, with an average of 62.07. These three groups are taller than the average for all nationalities, which is 61.99. The Jewish boys are close to the average, with a stature of 61.92 inches, while the Italians, on the average, attain only 61.18 inches.

If we consider the amount of growth, however, between age 14½ and age 15½—that is, the average height during the second year minus the average height during the first—the sequence is only slightly different. Americans stand at the head, with an average gain of 1.72 inches. Next come Germans, with 1.63 inches of growth, and English, Scotch and Irish with 1.34 inches. The average for all nationalities is 1.19 inches, and below this stand Jews with .94 inch, and Italians with .78 inch.

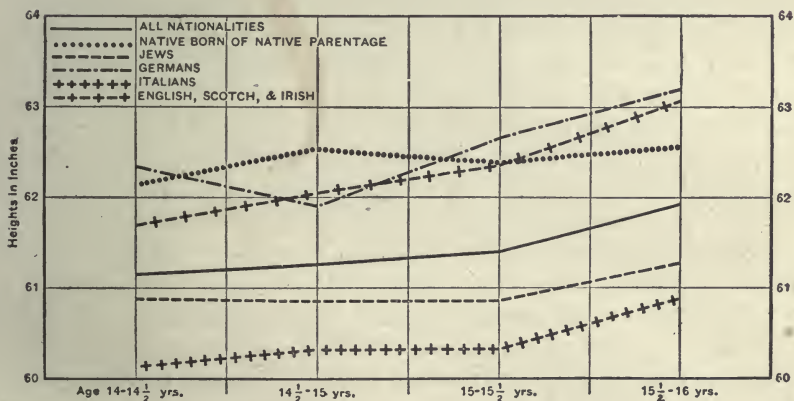
Graph G illustrates the corresponding data for girls.

The German girls average 62.39 inches in height; the average for American girls is only .01 inch less. The decrease in the stature of German girls, from 62.35 inches in the first half-year to 61.90 inches in the second half-year, is perhaps due to a selective process, the taller girls being the more likely to be sent to work at the earlier ages. The English, Scotch and Irish girls average 62.21 inches. The average for all nationalities is 61.35 inches. As with the boys, so with the girls also, Germans, Americans and English are above the average, while Jews and Italians tend to fall below; the average statures of the last two races being respectively 60.93 and 60.30 inches.

As regards the gain in height between ages  $14\frac{1}{2}$  and  $15\frac{1}{2}$ , the order of the nationalities presents a somewhat different aspect. British girls increase by .77 inch, and Germans by .67 inch. Below the general average of .40 inch, however, are Italians (.29 inch), Jews (.16 inch), and native American girls of native parentage, who gain only .14 inch.

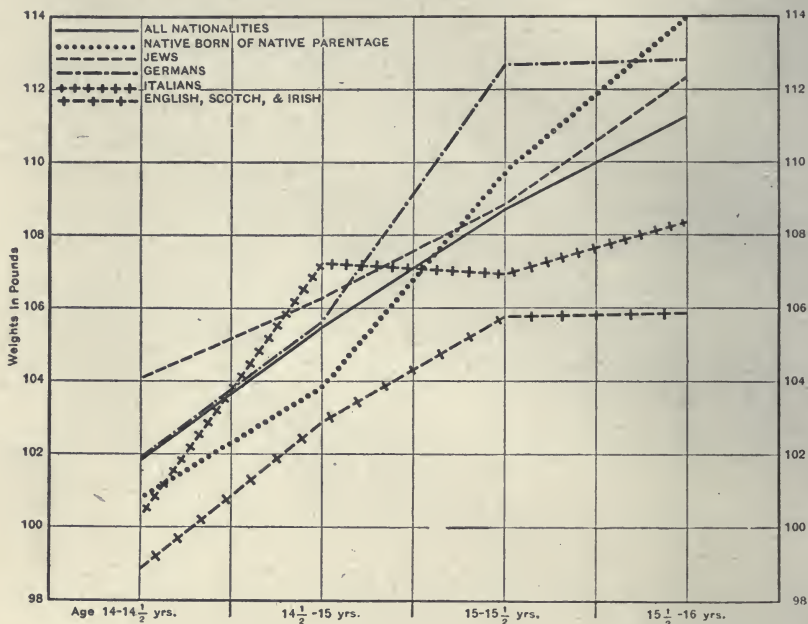
## GRAPH G

Average Heights of Girls of Various Nationalities at Each Half-year Period, Ages 14 to 16



## GRAPH H

### Average Weights of Boys of Various Nationalities at Each Half-year Period, Ages 14 to 16



Graph H shows the comparative weights of the boys of different nationalities.

The average weight for all nationalities is 105.71 pounds. The Jewish and the German boys are somewhat above the average for all nationalities, their weights for the two years being 106.92 and 106.62 pounds respectively. The American boys, *i. e.*, native-born of native parentage, average 105.61 pounds for the two years. The Italian boys are, for the most part, below the average with a weight of 104.61 pounds for the two years. English, Scotch and Irish boys are consistently lighter in weight than those of other nationalities, their average weight for the two years being only 102.44 pounds.

The average gain in weight for all nationalities is 6.31 pounds from the first year to the second. German and American boys stand at the head, gaining 9.30 and 9.15 pounds, respectively. Below the average increase are the British (5.45 pounds), Jews (5.09 pounds) and Italians (4.38 pounds).



Graph I illustrates the corresponding data for girls.

German girls average 108.24 pounds, outweighing those of other nationalities. American girls weigh 106.86 pounds. Jewish girls follow closely with an average weight of 106.34 pounds. All of these are above the average for all nationalities, which is 105.73 pounds. English, Scotch and Irish girls average 104.35 pounds. After them come Italian girls with 103.66 pounds, and Slavs with 103.37 pounds.

The British girls show the greatest gain in weight, 4.58 pounds, from age  $14\frac{1}{2}$  to age  $15\frac{1}{2}$ . Germans gain 3.96 pounds, and Americans 3.23 pounds. The average for all nationalities is 3.02 pounds. Below the average are Jews (2.44 pounds) and Italians (1.58 pounds).

In view of the preponderant part played by Jews and Italians in the constitution of our material, it has been of special interest to enter into an examination of these groups in greater detail. Table 14 (page 30) indicates the average height and weight of Jewish and Italian boys and girls by nativity and by half-year age-periods

## GRAPH I

Average Weights of Girls of Various Nationalities at Each Half-year Period, Ages 14 to 16

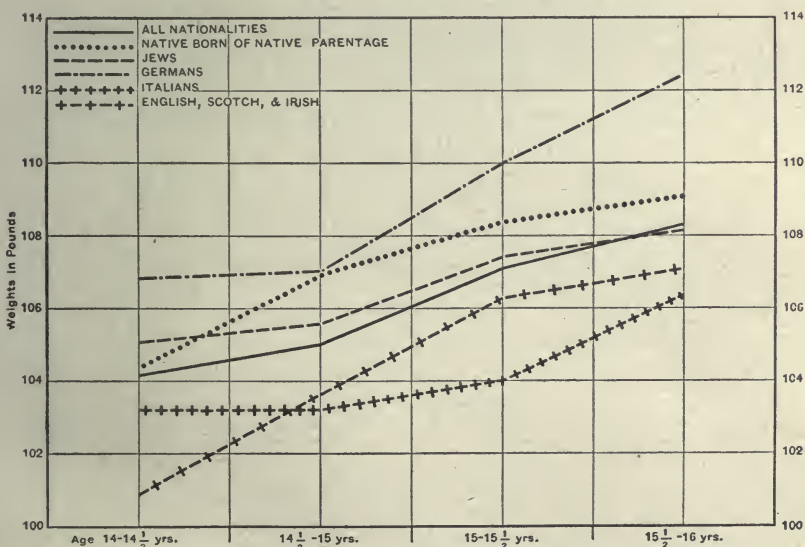


TABLE 14

# Number and Average Height and Weight of Jewish and Italian Boys and Girls, Ages 14 to 16

Classified by Native and Foreign Birth, and by Half-year Age-periods

NATIONALITY OR RACE STOCK AND HALF-YEAR AGE-PERIODS	BOYS			GIRLS		
	No of Chil- dren	Average Height in Inches	Average Weight in Pounds	No. of Chil- dren	Average Height in Inches	Average Weight in Pounds
<b>JEWS:</b>						
NATIVE-BORN						
Age: 14 to 14½ yrs.....	422	61.37	103.80	293	60.97	104.20
14½ to 15 yrs.....	270	62.08	107.36	251	61.03	106.17
15 to 15½ yrs.....	208	62.50	109.18	241	61.20	108.77
15½ to 16 yrs.....	121	63.40	115.05	140	61.79	109.85
Total—14 to 16 yrs..	1,021	62.03	107.17	925	61.17	106.78
FOREIGN-BORN						
Age: 14 to 14½ yrs.....	264	61.32	104.42	232	60.74	106.12
14½ to 15 yrs.....	256	61.60	105.14	210	60.65	104.85
15 to 15½ yrs.....	253	62.16	108.55	223	60.49	106.00
15½ to 16 yrs.....	144	62.42	109.96	143	60.78	106.61
Total—14 to 16 yrs..	917	61.80	106.63	808	60.65	105.84
<b>ITALIANS:</b>						
NATIVE-BORN						
Age: 14 to 14½ yrs.....	221	60.60	101.51	306	60.17	103.72
14½ to 15 yrs.....	144	61.55	108.21	179	60.29	102.88
15 to 15½ yrs.....	126	61.45	106.95	119	60.29	104.53
15½ to 16 yrs.....	56	61.57	107.67	54	60.87	108.07
Total—14 to 16 yrs..	547	61.14	105.16	658	60.28	103.99
FOREIGN-BORN						
Age: 14 to 14½ yrs.....	119	60.33	97.99	121	60.09	101.92
14½ to 15 yrs.....	78	61.46	105.51	79	60.41	103.98
15 to 15½ yrs.....	82	61.81	106.96	70	60.38	103.17
15½ to 16 yrs.....	51	62.15	109.07	37	60.94	103.84
Total—14 to 16 yrs..	330	61.25	103.71	307	60.34	102.97

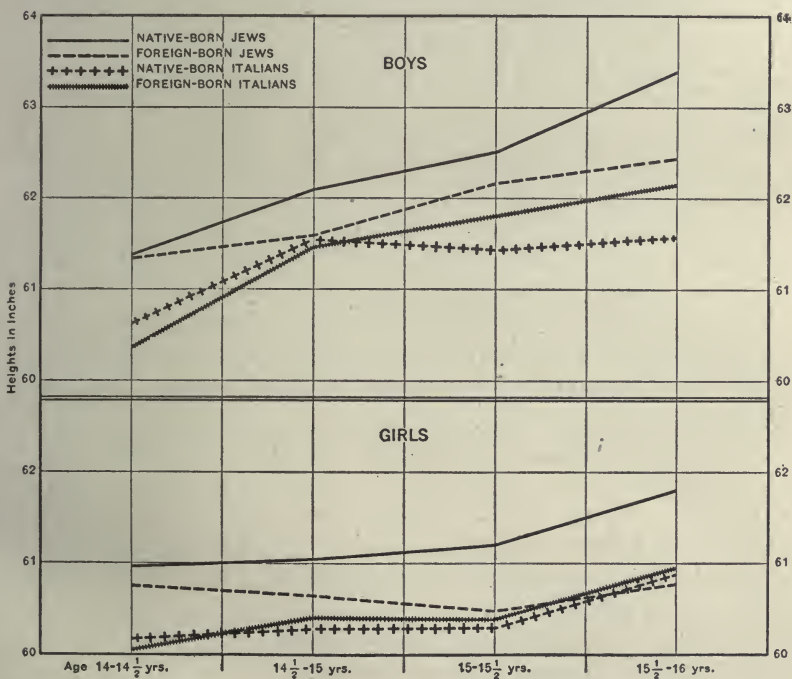
In practically every case the native Jewish children show improvement over the foreign-born Jewish children, both in stature and in weight. This is seen more clearly from Graphs J and K.

The native Jewish boys, starting with an advantage in their favor of only .05 inch in height in the first half-year, are .48 inch taller in the second, .34 inch in the third, and .98 inch in the fourth, with an average of .23 inch for the two years.

The American-born Jewish girls show an even greater superiority in stature over the foreign-born, the differences in their favor amounting to .23, .38, .71 and 1.01 inches, respectively, in the four half-years, with an average of .52 inch for the two years.

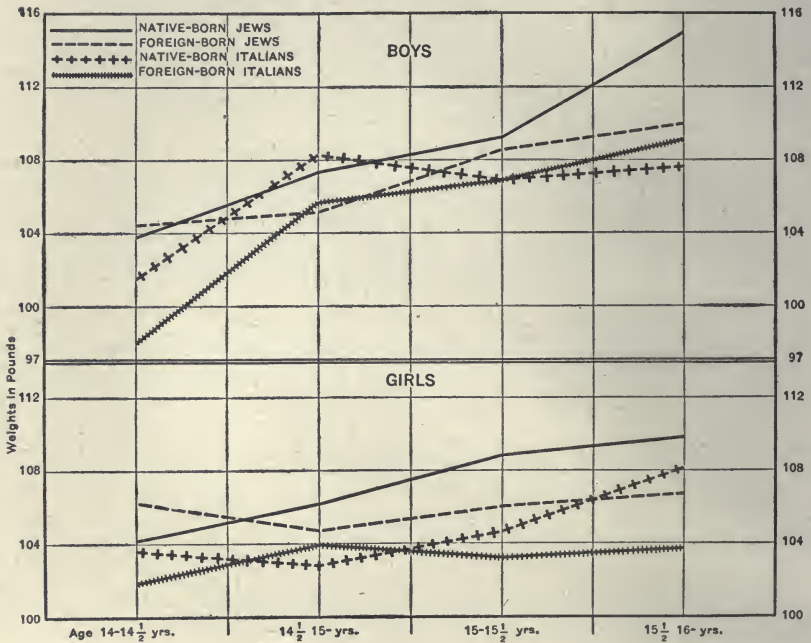
## GRAPH J

Average Heights of Native and Foreign Born Jewish and Italian Boys and Girls, at Each Half-year Period, Ages 14 to 16



## GRAPH K

### Average Weights of Native and Foreign Born Jewish and Italian Boys and Girls, at Each Half-year Period, Ages 14 to 16



In weight there are also marked differences, as is seen in Graph K.

In the first half-year the American-born Jewish boys are lighter than the foreign-born by an average of .62 pound. They overtake them, however, in the succeeding period, weighing 2.22, .63 and 5.09 pounds more in the second, third and fourth half-years respectively. For the two-year period as a whole, native-born Jewish boys are .54 pound heavier than the foreign-born.

The native-born Jewish girls are 1.92 pounds lighter in the first half-year, but heavier in the three succeeding half-years by 1.32 pounds, 2.77 pounds and 3.24 pounds, respectively. For the two years taken as a whole, the native-born Jewish girls are .94 pound heavier than the foreign-born girls of this race stock.

Among Italians, the native boys are .27 inch taller in the first half-year, but only .09 inch taller in the second. In the



third half-year the relationship is reversed, and the foreign-born actually exceed the natives in stature by a difference of .36 inch. In the fourth half-year the superiority of the native-born is regained, the difference in their favor being .42 inch. For the two years as a whole, native-born Italian boys are .11 inch shorter than the foreign-born. Among Italian girls, the native-born are taller only in the first half-year, by the narrow margin of .08 inch. During the remaining three age-periods the foreign-born girls have the advantage, with differences of .12, .09 and .07 inch, respectively. For the two years as a whole, native-born Italian girls are .06 inch shorter than the foreign-born.

The phenomena of weight among native and foreign born Italian children are quite different, however, from those of height. Among boys, natives show an excess of weight during the first two half-years with differences of 3.52 and 2.70 pounds. During the third and fourth half-years, on the other hand, the foreign-born are heavier, first by only .01 pound, then by 1.40 pounds. For the two years as a whole, native-born Italian boys are 1.45 pounds heavier than the foreign-born. Among Italian girls, on the other hand, the foreign-born are heavier only in the second age group, with a difference of 1.10 pounds. In the first, third and fourth half-years the native Italian girls have the advantage, with 1.80, 1.36 and 4.23 pounds, respectively. For the two years as a whole, native-born Italian girls are 1.02 pounds heavier than the foreign-born.

Professor Boas in his volume "Changes in Bodily Form of Descendants of Immigrants" gives similar data on the heights and weights of native and foreign born Jewish and Italian children, and it is of interest to compare our results with the figures in his investigation. To make the two sets of figures comparable, we have reduced ours from a half yearly to a yearly basis, and have grouped together the Boas figures for Sicilians and Neapolitans, which are given separately in his tables, to obtain the average for the Italians. The results are given in Table 15:

TABLE 15

**Differences in Height and Weight of Jewish and Italian Native  
and Foreign Born Boys and Girls, Ages 14 to 15,  
and 15 to 16**

Frankel and Dublin (1916), and Boas (1911) Figures

NATIONALITY OR RACE STOCK AGE AND SEX	SUPERIORITY* OF NATIVE OVER FOREIGN BORN			
	In Height (Inches)		In Weight (Pounds)	
	F. & D.	Boas	F. & D.	Boas
JEWISH BOYS:				
14 to 15 yrs.....	.19	.75	.41	1.98
15 to 16 yrs.....	.57	.23	2.28	.00
JEWISH GIRLS:				
14 to 15 yrs.....	.30	.39	— .41	...
15 to 16 yrs.....	.82	— .47	2.92	...
ITALIAN BOYS:				
14 to 15 yrs.....	.19	— .28	3.19	.88
15 to 16 yrs.....	— .45	— .55	— .60	— 2.20
ITALIAN GIRLS:				
14 to 15 yrs.....	— .01	.59	.67	...
15 to 16 yrs.....	— .10	— .23	2.24	...

\*A minus sign (—) denotes inferiority.

In general, our figures show the same tendency as those of Professor Boas, pointing to a superior development of the native-born Jewish children as compared with the foreign-born of this race stock, and to a relatively inferior development of native-born Italian children as compared with their foreign-born brethren. But, as is seen from the table, the extent of the differences between the native and foreign born children of these two nationalities varies in the two sets of data. Professor Boas interprets these results as follows: "Among the east European Hebrews, the American environment, even in the congested parts of the city, has brought about a general more favorable development of the body, which is expressed in the increased height of body (stature) and weight of the children. The Italian children, on the other hand, show no such favorable influence of American environment, but rather a small loss in

vigor as compared to the average condition of the immigrant children. It therefore appears that the south Italian race suffers under the influence of American city life, while the east European Hebrew develops under these conditions better than he does in his native country."\* This interpretation is clearly corroborated by our figures.

Comparing the figures of the native-born Jewish and Italian children with those of native-born of native parentage as given in Table 13 (page 24), we find that, although the native-born Jewish boys are taller than the foreign-born, they are nevertheless shorter than the native-born of native parentage by .28 inch for the two years. As regards weight, however, the native Jewish boys are in the lead. Their average weight for the two years is 107.17 pounds, exceeding that of the native-born boys of native parentage by 1.56 pounds. Among girls, the relationship is almost the same. The native Jewish girls are inferior in stature to the American girls by .21 inch, but in weight they are nearly equal to the native girls of native parentage, the difference in favor of the latter being only .08 pound.

The native-born Italian boys are 1.17 inches shorter and .45 pound lighter than the native boys of native parentage. Native-born Italian girls are 2.10 inches shorter and 2.87 pounds lighter than native girls of native parentage.

#### SUGGESTED STANDARDS OF PHYSICAL DEVELOPMENT

The examining officer, whose duty it is to determine the fitness of children to be subjected to the strain of industrial work, has a large discretionary power. It is important that he should have at his disposal bases for determining in some way, other than by personal impression, the question of whether or not an applicant conforms to reasonable standards. How, then, shall we proceed with the establishment of norms to govern the solution of this problem and what shall these norms be?

We have observed above that there are differences in the heights and weights of the children of the various nationalities. These differences are, however, too slight to warrant the adoption of special standards for each nationality. We shall, therefore, consider this subject without distinction for the race groups. Such standards as we shall develop will take into

\*"Changes in Bodily Form of Descendants of Immigrants", page 62.



consideration only the differences in the two sexes and in the two individual years, namely, 14 to 15 and 15 to 16. Shorter age-periods, such as half-years, will not be considered in this connection, in view of the minor changes in height and weight occurring from one period to another.

Our first consideration is to arrive at a basis by which normal development may be determined. Clearly, this basis cannot be height alone. As we have shown in Table 3 (page 5) 25% of the boys were under five feet in height; this was equally true for the girls. Indeed, 4.1% of the boys and 2.4% of the girls in this group were under four feet nine inches. These children are surely of short stature by any standard, and one would be tempted, on the score of height alone, to suggest the elimination of these boys and girls as still physically unfit for industrial work during such critical years as 14 to 16. But these boys and girls are often on examination as robust and well-formed as many taller children who apply for work papers. This is seen in Table 8 (page 16). Many are short through inheritance, although others are retarded in development for their age. Any strength test to which they might be put would in all probability show that many were physically as fit as those of average height for their age. It is clear, then, that we cannot determine normal development from a consideration of height alone, although health officers will often use their discretion to withhold certificates from children at the extremes of low height.

In the same way, a consideration of weight alone will lead to no constructive results, for, to have any meaning, weight must clearly be taken in relation to height. A weight of 100 pounds, while considerable, and even above the average for a child 60 inches in height, would be very low for a boy 67 inches tall. The only proper basis, therefore, is the relation of weight to height. The health officer's problem is, then, to note the weight of any applicant in relation to his height, and to see to what degree the actual figures correspond to the averages which were ascertained in this study, or to those prevailing in his own locality if such figures are at hand.

We shall now consider the average weights found by us for each height, and determine the minimum weights to be allowed for each inch of height for each of the two sexes and for each year of age. The following table gives the essential figures for our discussion:



TABLE 16

Number, Average Weights, Standard Deviations and Other  
Derived Values for Each Inch of Height of New York  
Boys and Girls, Ages 14 to 15 and 15 to 16 Years

BOYS												
Age 14 to 15							Age 15 to 16					
Height in Inches	No. of Child- ren	Average Weight (A) (Pounds)	Standard Deviation ( $\sigma$ ) (Pounds)	A- $\sigma$ in P'nds	No. of Child'n Below A- $\sigma$	$\frac{\sigma}{A}$ (Per cent.)	No. of Child- ren	Average Weight (A) (Pounds)	Standard Deviation ( $\sigma$ ) (Pounds)	A- $\sigma$ in P'nds	No. of Child'n Below A- $\sigma$	$\frac{\sigma}{A}$ (Per cent.)
	1	2	3	4	5	6	1	2	3	4	5	6
54....	13	82.27	5.84	77	2	7.1	5	85.60	—	—	—	—
55....	59	80.87	6.87	74	2	8.5	12	78.62	.38	78	5	.5
56....	96	83.27	10.06	73	3	12.0	33	81.23	6.49	75	4	8.0
57....	190	85.56	7.47	78	21	8.7	60	87.28	13.02	74	—	14.9
58....	283	88.03	8.28	80	28	9.4	101	88.14	7.21	81	15	8.2
59....	349	91.92	8.54	83	48	9.3	121	94.85	9.21	86	16	9.7
60....	440	97.47	9.29	88	67	9.5	201	99.72	11.41	88	28	11.5
61....	434	102.37	10.41	92	55	10.0	216	103.28	9.03	92	20	8.8
62....	400	107.03	11.12	96	58	10.4	266	107.45	9.92	98	39	9.3
63....	355	110.80	10.77	100	48	9.7	250	111.92	11.62	100	28	10.4
64....	307	116.58	12.23	104	39	11.0	220	116.81	10.78	106	34	9.2
65....	200	119.67	11.87	108	30	9.9	189	120.58	12.31	108	18	10.2
66....	137	124.09	11.59	113	20	9.4	131	125.41	15.95	109	11	12.8
67....	78	129.95	13.81	116	8	10.7	77	132.64	15.09	118	10	11.3
68....	34	135.01	12.89	122	3	9.6	42	131.35	14.31	117	7	10.9
69....	15	134.40	12.23	122	2	9.1	42	137.40	14.12	123	7	10.3
70....	6	142.00	13.85	128	1	9.8	10	143.55	8.68	135	2	6.1
71....	7	141.71	24.70	117	2	17.6	7	144.29	7.96	136	1	5.5
					437						247	

GIRLS												
Age 14 to 15							Age 15 to 16					
54....	8	81.94	5.27	77	2	6.5	3	91.00	—	—	—	—
55....	10	90.35	9.50	80	1	10.5	7	92.86	15.35	78	2	16.7
56....	47	89.47	11.67	78	7	13.1	29	89.57	8.34	81	6	9.5
57....	102	90.04	10.87	79	12	12.1	50	94.07	12.21	82	8	13.0
58....	247	95.25	12.37	83	39	13.0	110	98.73	12.88	86	16	13.0
59....	356	97.49	12.26	85	42	12.6	186	99.87	11.68	88	29	11.7
60....	513	102.07	13.12	89	69	12.9	309	103.17	14.22	89	41	13.8
61....	474	105.80	14.13	92	72	13.3	308	107.02	13.08	94	45	12.2
62....	409	107.57	12.97	95	57	12.1	285	109.18	13.44	96	44	12.3
63....	296	110.67	14.12	97	37	12.7	216	112.99	14.77	98	28	13.1
64....	167	114.76	15.88	99	21	13.8	154	115.09	16.17	99	17	13.9
65....	102	117.12	14.88	102	12	12.7	78	119.22	16.79	102	8	14.1
66....	56	122.31	21.15	101	4	17.3	51	123.47	15.75	108	6	12.8
67....	23	132.65	22.20	110	2	16.7	24	133.13	24.48	109	3	18.4
68....	6	129.33	22.49	107	—	17.4	8	127.75	12.86	115	1	10.0
69....	6	148.58	23.23	125	1	15.5	1	104.50	—	—	—	—
70....	1	118.50	—	—	—	—	—	—	—	—	—	—
71....	—	—	—	—	—	—	1	110.00	—	—	—	—
					378						254	

The first two columns have already been considered in Table 8 (page 16). They give the average weights for each inch of height. The average weights as given may be considered as norms for our purpose, except at the extremes of height, where the number of cases observed is small. These figures may be replaced by the smoothed values (also in Table 8) to which reference has already been made.

The problem now resolves itself into this: What departures or deviations may be permitted from the average weights in granting certificates? The children who are above the averages may be excluded from consideration. They are, if anything, better physical specimens of their class. Where overweight is so marked as to be a menace to the child, the physical examination will be likely to disclose defects of heart, kidney or other vital organ which should bar the applicant. The underweights are therefore our sole consideration, and the question still further reduces itself to the determination of the minimum weights which are consistent with physical fitness.

An interesting suggestion was made in this connection by Porter\*, who urged that a child whose physical development departs more than the probable deviation from the average weight for his height, should be considered sub-normal. This suggestion attracted our attention, for it seemed to give the very value which would serve as a first approximation for the determination of the minimum weights to be used by health officers. We have used this suggestion in Table 16. The standard deviations ( $\sigma$ ) are given for the average weights for each inch of height. If we follow the method of Porter, the children whose weights were below the average by a number of pounds equal to the standard deviation, would be excluded. Column 4 gives the minimum weight values on this basis. Column 5 gives the number of children who would fall below this limit ( $A - \sigma$ ). We have also included the percentage deviation from the average which is allowed according to this method, namely,  $\frac{\sigma}{A}$ . This is shown in Column 6. Among boys, age 14 to 15, there would be 437, or 12.8%, who would have to be excluded on this basis. In like manner, 247 boys, or 12.4%, would be eliminated at age 15 to 16; 378 girls, or 13.4%, at age 14 to 15; and 254 girls, or 13.9%, at age 15 to 16.

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\*W. Townsend Porter, "On the Application to Individual School Children of the Mean Values Derived from Anthropological Measurements by the Generalizing Method." Publications of The American Statistical Association. Vol III, Boston, 1893.

Summarizing the above, we may say that an approximate deviation of 10% from the average weight of boys for each height, and a deviation of about 12% from the average weight of girls, would result in the dropping of over 13% of the children on the score of deficient weight for their height. Attractive and highly desirable as this may be as a social programme for the conservation of child life and the prevention of the premature entry of children into industrial work, the authors are nevertheless not ready to suggest the adoption of so radical a standard. They are aware that they have considered in this investigation applicants who were actually granted work papers, and it has seemed to them that the elimination of 13% of such children on the score of insufficient weight for their height would involve too great a departure from present practice. It is, therefore, suggested that a somewhat greater deviation from the average be permitted, namely, 15%. This is along the lines of the practice of life insurance companies, which allow a deviation of 20% above and below the average weight for each height, in passing upon the acceptability of a risk for life insurance. Allowing for the lesser variability in weight for given heights on the part of children as compared with adults, the limit of 15% seems reasonable. On this basis, which is approximately  $1\frac{1}{2}\sigma$  instead of  $1\sigma$ , not 684 cases, but 189 cases, or 3.5%, would be eliminated among the boys, and not 632 cases, but 436 cases, or 9.4%, would be eliminated among the girls. This is more conservative, and would seem to meet satisfactorily the requirements of the case.

It is realized that this 15% limit works out more stringently with the girls than with the boys, excluding as it does a much higher percentage of the former than of the latter. But it seems that social considerations fully warrant such discrimination. In the large majority of cases the girls enter economic employment only for a temporary period. They give up industrial work when they marry, and enter upon their natural vocation of motherhood. This is their most important function, and it requires preeminently an unimpaired physical condition. The longer that their entry into the stress and strain of employment is postponed, the better are their chances to develop the faculties which are essential to strong motherhood. The health officer should, therefore, scrutinize most carefully the girls on the border line. The apparent discrimination which our suggested minimum weight-limit works against



the girls does not affect them unfairly, when considered from the broader viewpoint of social expediency.

We would urge, then, that our averages, as given in Table 8 (page 16) be considered normal weights for each height for New York children ages 14 to 15 and 15 to 16, and that a deviation of 15% below these averages be regarded as the maximum departure which can safely be permitted in granting work papers. The following Table 17 gives the minimal weights so computed for each of the two years and each of the two sexes. It is based on the smoothed weights for the various heights, presented in Table 8.

**TABLE 17**  
**Suggested Minimum Weight Limits for Each Inch of Height**  
**of New York Boys and Girls, Ages 14 to 15 and**  
**15 to 16 Years**

HEIGHTS (In Inches)	WEIGHTS (In Pounds)			
	BOYS		GIRLS	
	Age 14 to 15	Age 15 to 16	Age 14 to 15	Age 15 to 16
57.....	73	74	78	82
58.....	76	77	81	83
59.....	79	80	84	85
60.....	83	84	86	87
61.....	86	88	89	90
62.....	91	91	92	93
63.....	95	95	95	96
64.....	99	99	98	99
65.....	103	103	101	102
66.....	106	107	105	105
67.....	110	110	108	108
68.....	113	114	112	112

It will be observed that these so-called minimal weights are given for heights 57 to 68 inches. Figures were at hand for the heights at the lower and upper extremes, but these were so clearly marred by the fewness of the cases on which they were based, that we did not feel warranted in drawing conclusions from such data. Children whose stature is below 57 inches should receive the especial attention of medical examiners, and should be certificated only in the absence of physical defects, and should, moreover, be required to weigh at least as much as is suggested for height 57 inches—namely, 73 pounds for boys 14 to 15, 74 pounds for boys 15 to 16, and 78 and 82 pounds



respectively for girls at ages 14 to 15 and 15 to 16. These weights correspond to a lesser departure than 15% from the averages, but public policy would seem to require added restrictions on these abnormal cases.

### CONCLUSION

The writers have endeavored, in this paper, to present standards of height and weight for the determination of physical fitness of children to be certificated for employment. It should be borne in mind, however, that heights and weights, while important factors, are not, in themselves, sufficient guides for this purpose. It is understood that every child is required to undergo a thorough medical examination, in which the eyesight and hearing, the condition of the teeth and the pharynx and palate are examined, and in which the functioning of the heart and lungs is carefully tested. It is to be assumed that a lesion in any of the vital organs of the child will cause the examiner to refuse an employment certificate, regardless of height and weight.

In this connection it is interesting to recall additional standards that have been suggested by scientific authorities. Crampton, Rotch\* and others hold that the stage of physiological development should be taken into consideration. They point out that there is a marked difference between the chronologic and the physiologic age of children, and direct attention, among other things, to the different stages of puberty and of ossification of the wrist bones and of the epiphyses of the radius and ulna. Thus a child may satisfy the requirements of the law as to chronologic age, but, anatomically, may be found to correspond to the normal development of a child much younger. Obviously the strain of industrial work would result in harm to such a child. These are matters the importance of which will be appreciated in time as the communities awaken to the importance of the subject and make the requirements for issuing employment certificates more stringent. However, as long as present conditions obtain, it is hoped that the contribution of the authors on the subject of height and weight will be generally applied, and that it will serve to better the interests of the children even under the present law.

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\*C. Ward Crampton, "Physiological Age—A Fundamental Principle," American Physical Education Review, Vol. XIII, 1908.

Thomas Morgan Rotch, "Chronologic and Anatomic Age in Early Life," The Journal of the American Medical Association, Vol. LI, Chicago, 1908.

## SUMMARY

This study may be summarized as follows:

1. More than half of the children, 59.2% of the boys and 56.2% of the girls, applied for employment certificates immediately upon satisfying the requirements of the law as to age and school grade.

2. The average height of boys 14 to 15 years old is 61.55 inches; of boys 15 to 16 years old, 62.74 inches; of girls 14 to 15 years old, 61.19 inches; of girls 15 to 16 years old, 61.59 inches. In each of these two years the stature of boys is greater than that of girls.

3. The boys are distributed over a greater range of heights than the girls. The interquartile range, that is, the limits which include the central 50% of the cases, is 4.26 inches for the boys and 3.05 inches for the girls.

4. In the period between the first quarter of the fifteenth and the last quarter of the sixteenth year, the boys show an increase in height of 2.01 inches and the girls only .71 inch.

5. The average weight of boys 14 to 15 years old is 103.38 pounds; of boys 15 to 16 years old, 109.69 pounds; of girls 14 to 15 years old, 104.54 pounds; and of girls 15 to 16 years old, 107.57 pounds.

6. The boys are distributed over a greater range of weights than the girls, their interquartile range being 23.7 pounds, as against 19.83 pounds for the girls.

7. In the period between the first quarter of the fifteenth and the last quarter of the sixteenth year, the boys gain 10.56 pounds and the girls gain only 3.61 pounds.

8. The coefficient of correlation between height and weight for boys 14 to 15 years old is .776; for boys 15 to 16 years old, .759; for girls 14 to 15 years old, .499; for girls 15 to 16 years old, .439. The coefficients of correlation are higher for boys than for girls; and for both sexes the coefficient is higher in the first than in the second year under consideration.

9. Up to about 63 inches, the girls are heavier than the boys for the same height; but beyond that height, the boys are heavier than the girls.

10. For the two-year period 14 to 16, taken as a unit, the children in higher grades are taller than those in lower grades. Among boys, graduates are taller by .18 inch, and high school boys by .48 inch, than those in grade 7A. Among girls, gradu-

ates are taller by .35 inch, and high school pupils by .62 inch, than those in grade 7A. The heights of both boys and girls show irregular fluctuations in the intermediate grades.

11. The boys do not show any definite correlation of weight with school grade. During the two-year period, the boys in grade 7A are .30 pound heavier than the graduates, but .89 pound lighter than high school pupils. The weights fluctuate irregularly in the intermediate grades. The girls show a more decided tendency towards an increase in weight with an advance in school grade. Graduates are .08 pound heavier, and high school pupils are 2.34 pounds heavier than girls in grade 7A.

12. The distribution by nationality or race stock of the children covered by this investigation was as follows: Jews, 36.6%; Italians, 18.3%; native-born of native parentage, 16.1%; English, Scotch and Irish, 10.9%; Germans, 9.5%; Slavs, 2.8% miscellaneous group, 5.8%.

13. The proportion of boys is greater than that of girls for each nationality or race stock, except the Italian.

14. The German boys are tallest, with an average height for the two years of 62.49 inches; native-born boys of native parentage average 62.31 inches; English, Scotch and Irish, 62.07 inches; Jewish, 61.92 inches; Italian, 61.18 inches.

15. Among the girls, the Germans are tallest, averaging for the two years 62.39 inches. The native-born of native parentage average 62.38 inches; English, Scotch and Irish, 62.21 inches; Jews, 60.93 inches; Italians, 60.30 inches.

16. The native-born boys of native parentage gain 1.72 inches in height from the first to the second of the two years under discussion; the Germans, 1.63 inches; English, Scotch and Irish, 1.34 inches; Jews, .94 inch; Italians, .78 inch. Among the girls, the English, Scotch and Irish lead, with an increase of .77 inch; the Germans gain .67 inch; Italians, .29 inch; Jews, .16 inch; native-born girls of native parentage, .14 inch.

17. The Jewish boys are heaviest, with an average weight for the two years of 106.92 pounds; German boys average 106.62 pounds; native-born boys of native parentage, 105.61 pounds; Italians, 104.61 pounds; English, Scotch and Irish, 102.44 pounds.

18. The German girls are heaviest, with an average of 108.24 pounds. The native-born girls of native parentage weigh 106.86 pounds; Jews, 106.34 pounds; English, Scotch and Irish, 104.35 pounds; Italians, 103.66 pounds.



19. The German boys lead in gain in weight from the first to the second year, with an increase of 9.30 pounds; native-born boys of native parentage gain 9.15 pounds; English, Scotch and Irish, 5.45 pounds; Jews, 5.09 pounds; Italians, 4.38 pounds.

20. Among the girls, the English, Scotch and Irish lead in gain in weight from the first to the second year, with an increase of 4.58 pounds; Germans, 3.96 pounds; native-born of native parentage, 3.23 pounds; Jews, 2.44 pounds; Italians, 1.58 pounds.

21. Native-born Jewish boys are .23 inch taller and .54 pound heavier than the foreign-born. The native-born Jewish girls are .52 inch taller and .94 pound heavier than the foreign-born.

22. The native-born Italian boys are .11 inch shorter but 1.45 pounds heavier than the foreign-born for the two years. The native-born Italian girls are likewise .06 inch shorter, but 1.02 pounds heavier than the foreign-born during the same period.

23. For practical purposes, the differences in height and weight of the various nationalities are not sufficiently large to warrant a special standard for each nationality for the determination of minimum requirements.

24. A departure of 15% from the average weight for a given height is suggested as the limit below which children should be refused employment certificates, even if the medical examiner pronounces them well in other regards. In no case should a certificate be granted to a child whose weight is less than 70 pounds.



## APPENDIX I

While this study was in press the writers received, through the courtesy of Dr. Leonard W. Hatch, Chief Statistician of the New York State Department of Labor, figures for the heights and weights of 4,449 children to whom employment certificates were granted in 1909-1910. These children were in the cities of Buffalo, Rochester, Syracuse, Schenectady and Yonkers. In these cities the height and the weight of each child applying for an employment certificate are carefully recorded by the health department. It is interesting to compare the averages for the New York City children with those of the up-state children.

Table 18, on the following page, presents a comparison of heights and weights for the two-year period from ages 14 to 16, for the individual years 14 to 15 and 15 to 16, and for each of the eight quarter-year periods.

TABLE 18

**Comparison of Heights and Weights of Boys and Girls  
Granted Employment Certificates in New York City and in  
Up-State Cities**

Arranged by Quarter and Full Year Age-periods, Ages 14 to 16 Years

AGE-PERIOD AND LOCALITY	BOYS				GIRLS			
	Number of Children	Average Height (Inches)	Average Weight (Pounds)	No. of Pounds Per Inch	Number of Children	Average Height (Inches)	Average Weight (Pounds)	No. of Pounds Per Inch
<b>14 to 16 Years:</b>								
New York City.	5,393	61.99	105.71	1.71	4,650	61.35	105.79	1.72
Up-State Cities.	2,627	61.31	100.68	1.64	1,822	61.60	103.30	1.68
<i>Difference...</i>		.68	5.03	.07		-.25	2.49	.04
<b>14 to 15 Years:</b>								
New York City.	3,405	61.55	103.38	1.68	2,827	61.19	104.54	1.71
Up-State Cities.	1,786	60.90	98.60	1.62	1,300	61.46	102.18	1.66
<i>Difference...</i>		.65	4.78	.06		-.27	2.36	.05
<b>15 to 16 Years:</b>								
New York City.	1,988	62.74	109.69	1.75	1,823	61.59	107.57	1.75
Up-State Cities.	841	62.17	105.09	1.69	522	61.96	106.09	1.71
<i>Difference...</i>		.57	4.60	.06		-.37	1.48	.04
<b>14 to 14½ Years:</b>								
New York City.	1,216	61.14	101.52	1.66	1,033	61.12	104.28	1.71
Up-State Cities.	786	60.59	97.21	1.60	590	61.23	100.88	1.65
<i>Difference...</i>		.55	4.31	.06		-.11	3.40	.06
<b>14½ to 14¾ Years:</b>								
New York City.	786	61.52	102.55	1.67	591	61.21	104.02	1.70
Up-State Cities.	393	60.74	97.94	1.61	271	61.39	100.99	1.65
<i>Difference...</i>		.78	4.61	.06		-.18	3.03	.05
<b>14¾ to 15 Years:</b>								
New York City.	724	61.72	103.97	1.68	623	61.22	105.87	1.73
Up-State Cities.	328	61.33	100.62	1.64	224	61.92	103.70	1.67
<i>Difference...</i>		.39	3.35	.04		-.70	2.17	.06
<b>14½ to 15 Years:</b>								
New York City.	679	62.13	107.05	1.72	580	61.29	104.10	1.70
Up-State Cities.	279	61.52	101.07	1.64	215	61.71	105.67	1.71
<i>Difference...</i>		.61	5.98	.08		-.42	-1.57	-.01
<b>15 to 15½ Years:</b>								
New York City.	698	62.44	107.44	1.72	616	61.43	107.31	1.75
Up-State Cities.	331	62.00	103.91	1.68	197	61.85	105.98	1.71
<i>Difference...</i>		.44	3.53	.04		-.42	1.33	.04
<b>15½ to 15¾ Years:</b>								
New York City.	565	62.74	110.36	1.76	525	61.39	106.92	1.74
Up-State Cities.	221	62.32	106.62	1.71	136	62.08	105.83	1.70
<i>Difference...</i>		.42	3.74	.05		-.69	1.09	.04
<b>15¾ to 15¾ Years:</b>								
New York City.	446	62.96	110.87	1.76	409	61.93	108.55	1.75
Up-State Cities.	190	62.33	105.34	1.69	112	61.99	105.63	1.70
<i>Difference...</i>		.63	5.53	.07		-.06	2.92	.05
<b>15¾ to 16 Years:</b>								
New York City.	279	63.15	112.08	1.77	273	61.83	107.89	1.74
Up-State Cities.	99	62.09	105.11	1.69	77	61.97	107.47	1.73
<i>Difference...</i>		1.06	6.97	.08		-.14	.42	.01

The New York City boys show a consistently greater average height at each age-period; the difference in their favor amounts to .68 inch for the two-year period. The New York City girls, on the other hand, are shorter than the up-state girls at each age-period, the difference for the two years being .25 inch. As regards the relative heights of the sexes, it may be pointed out that, while the New York boys are taller than the New York girls in each period, the up-state boys are taller than the up-state girls only in the second year; in the first year the opposite relationship obtains.

In weight as well as in height, the New York boys are superior to the up-state boys in each age-period. For the two-year period there is a difference of 5.03 pounds in their favor. The New York girls are likewise heavier than the up-state girls at each age, except in the period  $14\frac{3}{4}$  to 15 years. For the two-year period the difference in favor of the former is 2.49 pounds. New York City boys are heavier than New York City girls after the third quarter of the fifteenth year; the up-state boys, on the contrary, are lighter than the up-state girls in every period, except at age  $15\frac{1}{4}$  to  $15\frac{1}{2}$ .

Both boys and girls of New York City are stockier than up-state children; that is, they show a greater weight per inch of height. For the two-year period the New York City boys are .07 pound heavier, and the New York City girls are .04 pound heavier, than the up-state children of the respective sexes, per inch of height. Among both New York City and up-state children the girls are stockier than the boys. The differences are small, to be sure, but may be significant. Thus the New York girls are .01 pound heavier, and the up-state girls are .04 pound heavier, than the corresponding groups of boys, per inch of height. These differences would be appreciably increased if allowances were made for the higher heels worn by girls.

# APPENDIX II

## TABLE 19—Part A

Number and Average Weights for Each Half-inch of Height of New York Boys,  
Ages 14 to 16 Years, for Each Quarter-year of Age

Height in Half- inches	14 to 14½ yrs.		14½ to 14¾ yrs.		14¾ to 14¾ yrs.		14¾ to 15 yrs.		15 to 15½ yrs.		15½ to 15¾ yrs.		15¾ to 15¾ yrs.		15¾ to 16 yrs.	
	Number of Children	Average Weight	Number of Children	Average Weight	Number of Children	Average Weight	Number of Children	Average Weight	Number of Children	Average Weight	Number of Children	Average Weight	Number of Children	Average Weight	Number of Children	Average Weight
49																
49½					1	88.00										
50																
50½																
51																
51½																
52																
52½	1	80.00							1	76.50						
53									1	96.00						
53½																
54	2	78.50							2	76.25			1	123.00		
54½	5	84.60	1	80.00					2	76.25						
55	9	80.67	8	79.19	1	76.00	2	79.75	1	77.00			2	75.75	1	80.00
55½	12	80.50	11	83.64	6	80.75	3	79.17	2	80.75			1	79.00	2	79.25
56	8	83.25	11	78.77	12	84.50	11	81.68	7	78.93	4	76.38	2	85.25	2	80.25
56½	21	85.21	10	83.20	12	79.79	11	88.14	7	86.14	4	85.63	6	77.92	1	78.50
57	34	85.88	18	84.67	22	83.16	18	83.14	13	87.50	6	86.17	5	88.40	4	84.13
57½	45	87.39	20	84.23	23	87.43	10	85.90	11	84.11	12	93.08	6	85.75	3	82.33
58	61	87.41	34	85.93	27	87.59	19	85.76	26	87.21	17	90.74	13	86.92	5	93.80
58½	65	89.55	30	87.18	24	89.79	23	90.15	17	86.79	12	86.17	7	86.57	4	94.50
59	78	90.14	49	91.59	33	90.61	26	93.19	18	94.92	15	95.07	12	94.88	8	96.13
59½	68	93.42	42	91.33	31	93.32	22	93.98	32	94.58	14	95.93	15	94.33	7	92.86
60	87	94.96	43	96.00	54	97.98	32	96.97	53	98.77	33	102.24	18	98.25	14	100.64
60½	88	97.92	51	98.68	43	99.71	42	99.17	23	97.22	27	96.41	21	104.37	12	102.17
61	96	101.74	48	98.68	42	103.90	41	102.43	41	101.67	41	106.43	26	102.21	14	99.50
61½	67	102.75	57	101.68	43	103.78	40	105.49	31	104.15	29	102.86	20	102.38	14	104.86
62	86	104.56	54	102.79	40	104.73	57	106.01	53	107.21	52	106.18	29	105.67	15	104.27
62½	50	108.43	41	113.27	39	109.55	33	112.15	43	106.78	30	109.13	22	109.39	22	112.66
63	64	108.44	39	109.40	49	109.67	47	111.57	49	109.04	40	111.36	29	110.88	22	113.80
63½	52	112.66	37	111.72	28	112.77	39	111.82	30	111.27	30	112.25	30	113.93	20	117.05
64	57	113.74	39	115.95	35	114.54	42	117.82	46	112.64	29	115.03	27	115.61	17	116.21
64½	38	119.29	37	117.88	23	114.11	36	119.65	20	121.70	31	122.32	37	117.84	13	115.15
65	26	119.85	25	118.96	29	117.91	27	119.52	40	118.73	19	127.53	26	119.13	19	118.92
65½	28	120.96	20	118.68	28	118.55	17	124.53	28	120.27	32	121.25	14	123.39	11	116.95
66	21	125.55	17	122.94	23	122.83	21	123.07	27	125.11	18	123.42	22	126.81	9	123.94
66½	15	128.30	9	120.89	14	125.29	17	123.41	20	125.03	13	123.69	14	127.82	8	128.31
67	12	140.79	12	126.71	13	121.50	11	125.91	15	129.27	18	127.28	7	139.07	5	137.30
67½	9	140.61	3	121.83	10	122.65	8	138.00	7	139.29	9	132.89	9	133.28	7	136.07
68	4	135.13	6	133.50	2	133.75	6	134.42	12	131.04	8	127.44	7	138.93	5	123.70
68½	1	111.50	7	134.29	3	135.33	5	143.50	4	129.00	3	143.00	3	129.50		
69	1	125.50	2	131.25	2	137.25	4	133.13	10	132.75	4	155.13	9	134.50	6	138.33
69½	1	135.00			2	138.75	3	136.17	2	123.75	6	144.83	2	128.50	3	136.33
70			1	150.00					2	143.50	1	133.00			2	143.75
70½	1	115.50	2	148.25	2	145.00			1	137.00	1	149.00	2	141.50	1	159.00
71	1	171.00			2	142.25	2	128.00			3	144.17	2	134.75	2	154.00
71½	2	140.25														
72																
72½																
TOTAL	1,216	101.52	786	102.55	724	103.97	679	107.05	698	107.44	565	110.36	446	110.87	279	112.03
Average Height	61.14		61.52		61.72		62.13		62.44		62.74		62.96		63.15	



# APPENDIX II—(Continued).

## TABLE 19—Part B

Number and Average Weights for Each Half-inch of Height of New York Girls,  
Ages 14 to 16 Years, for Each Quarter-year of Age

Height in Half- inches	14 to 14½ yrs.		14½ to 14¾ yrs.		14¾ to 15 yrs.		15 to 15½ yrs.		15½ to 15¾ yrs.		15¾ to 15¾ yrs.		15¾ to 16 yrs.	
	Number of Children	Average Weight	Number of Children	Average Weight	Number of Children	Average Weight	Number of Children	Average Weight	Number of Children	Average Weight	Number of Children	Average Weight	Number of Children	Average Weight
49														
49½														
50														
50½					1	84.00								
51					1	87.00								
51½														
52														
52½									1	112.50				
53					1	74.50								
53½							1	69.00	1	144.00				
54	3	83.33							1	96.00				
54½	1	77.50	1	80.50	2	82.75	1	82.00	1	90.00			1	93.50
55			1	85.50	1	95.00			1	81.75				
55½	3	99.67	2	82.25	3	86.50			2	98.25	1	77.00		
56	12	89.38	5	87.80	7	81.64	2	100.50	6	90.25	4	95.17		
56½	6	93.17	3	81.50	8	95.00	4	89.38	3	87.33	5	86.10	4	84.63
57	15	91.70	13	89.31	10	91.25	13	89.15	6	93.75	14	84.50	2	94.75
57½	17	88.62	9	90.56	12	91.83	13	88.65	7	87.64	12	96.79	2	94.75
58	48	93.63	27	94.26	27	92.02	20	97.45	22	96.14	8	93.26	9	102.50
58½	49	96.21	27	96.89	28	99.16	21	92.69	26	100.80	21	98.02	14	99.57
59	77	94.11	36	99.39	38	98.50	40	97.28	36	97.42	29	98.14	13	105.54
59½	73	99.56	30	98.68	30	97.00	32	97.13	23	101.37	35	99.86	18	181.00
60	105	99.65	78	102.29	58	101.65	51	100.01	78	103.94	49	100.77	34	102.09
60½	79	104.09	38	99.71	58	105.23	47	104.43	42	104.90	36	99.25	31	103.65
61	97	105.45	46	106.96	45	104.09	63	105.90	74	106.96	43	108.44	42	106.01
61½	80	108.07	52	105.16	38	105.45	53	104.18	43	105.99	29	108.52	32	108.03
62	73	107.45	45	105.49	63	107.53	52	104.10	53	107.47	65	107.65	35	103.89
62½	64	109.79	44	107.57	36	110.33	32	108.94	32	110.86	26	110.90	29	112.74
63	61	110.40	31	110.89	36	111.88	35	108.16	40	111.51	37	112.88	29	114.38
63½	46	111.60	21	106.86	36	113.75	30	110.04	30	115.57	22	114.68	24	113.94
64	31	112.52	27	112.83	22	116.45	14	109.14	31	113.64	20	118.38	19	115.45
64½	25	116.56	13	113.62	14	122.07	21	116.24	16	114.34	15	120.40	21	117.10
65	24	116.93	12	113.08	13	119.65	8	126.44	10	123.60	9	124.44	15	113.60
65½	18	118.03	10	111.55	7	122.43	9	111.28	10	121.80	15	118.88	7	118.07
66	9	123.33	10	115.90	14	120.29	4	135.25	6	121.00	13	124.08	7	130.14
66½	6	117.08	6	120.75	4	145.00	3	116.17	6	123.75	3	123.67	7	120.36
67	4	135.25	3	148.50	5	135.90	6	127.08	9	138.39	4	139.13	4	122.75
67½	3	124.17	1	142.00			1	108.00	3	130.00	1	154.50	3	119.17
68					1	179.00	1	118.00			2	128.75	2	128.25
68½	2	114.25			1	124.00	1	126.50	1	126.00	1	119.00		
69	2	139.00			3	147.83	1	170.00					1	104.50
69½														
70														
70½							1	118.50						
71														
71½													1	110.00
72														
72½														
TOTAL	1,033	104.28	591	104.02	623	105.87	580	104.10	616	107.31	525	106.92	409	108.55
Average Height	61.12		61.21		61.22		61.29		61.43		61.39		61.93	

## TABLE 20—Part A

# Correlation between Heights and Weights of New York Boys, 14 to 15 Years of Age

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# APPENDIX II—(Continued).

## TABLE 20—Part B

### Correlation between Heights and Weights of New York Boys, 15 to 16 Years of Age

Height in Inches		WEIGHTS IN GROUPS OF 5 POUNDS																												Total Cases	Average Weight			
		65 to 69	70 to 74	75 to 79	80 to 84	85 to 89	90 to 94	95 to 99	100 to 104	105 to 109	110 to 114	115 to 119	120 to 124	125 to 129	130 to 134	135 to 139	140 to 144	145 to 149	150 to 154	155 to 159	160 to 164	165 to 174	175 to 179	180 to 184	185 to 189	190 to 194	195 to 199	200 to 204	205 to 209			210 to 214	215 to 219	220 to 224
49																																	2	86.25
50												1																					5	85.60
51																																	12	78.62
52																																	33	81.23
53																																	60	87.28
54																																	101	88.14
55																																	121	94.85
56																																	201	99.72
57																																	216	103.28
58																																	266	107.45
59																																	250	111.92
60																																	220	116.81
61																																	189	120.58
62																																	131	125.41
63																																	77	132.64
64																																	42	131.35
65																																	42	137.40
66																																	10	143.55
67																																	7	144.29
68																																	3	149.00
69																																	1,988	109.69

# APPENDIX II—(Continued).

## TABLE 20—Part C

### Correlation between Heights and Weights of New York Girls, 14 to 15 Years of Age

Height in Inches			WEIGHTS IN GROUPS OF 5 POUNDS																								Total Cases	Average Weight									
			65 to 69	70 to 74	75 to 79	80 to 84	85 to 89	90 to 94	95 to 99	100 to 104	105 to 109	110 to 114	115 to 119	120 to 124	125 to 129	130 to 134	135 to 139	140 to 144	145 to 149	150 to 154	155 to 159	160 to 164	165 to 169	170 to 174	175 to 179	180 to 184			185 to 189	190 to 194	200 to 204	205 to 209	210 to 214	215 to 219	220 to 224		
49			1																														1	84.00			
50								1																									1	87.00			
51								1																									2	71.75			
52							2	2																										8	81.94		
53							2	2																										10	90.35		
54	1						4	1																										10	89.47		
55		1					10	5																										47	90.04		
56			1				12	26																										102	95.25		
57			2				16	36																										247	97.49		
58			1				7	34																										356	97.49		
59			1				7	31																										513	102.07		
60								39																											474	108.80	
61								15																											409	107.57	
62								34																											296	110.67	
63								45																											167	114.76	
64								4																											102	117.12	
65								4																											56	122.31	
66								1																											23	132.65	
67																																			6	129.33	
68																																			6	148.58	
69																																			1	118.50	
70																																					
71																																					
72																																					
Total Cases	1	6	57	165	219	307	410	400	327	290	237	141	100	54	44	18	13	13	7	4	1	3	3	1					2				1	2,827	104.54		



# APPENDIX II—(Continued).

## TABLE 20—Part D

### Correlation between Heights and Weights of New York Girls, 15 to 16 Years of Age

Height in Inches		WEIGHTS IN GROUPS OF 5 POUNDS																																Total Cases	Average Weight
65 to 69	70 to 74	75 to 79	80 to 84	85 to 89	90 to 94	95 to 99	100 to 104	105 to 109	110 to 114	115 to 119	120 to 124	125 to 129	130 to 134	135 to 139	140 to 144	145 to 149	150 to 154	155 to 159	160 to 164	165 to 169	170 to 174	175 to 179	180 to 184	185 to 189	190 to 194	195 to 199	200 to 204	205 to 209	210 to 214	215 to 219	220 to 224				
49																																	1	112.50	
50																																	2	131.25	
51																																	3	93.16	
52																																	7	92.86	
53																																	29	89.57	
54																																	50	94.07	
55																																	110	98.73	
56																																	186	99.87	
57																																	308	103.17	
58																																	285	109.18	
59																																	216	112.99	
60																																	154	115.09	
61																																	78	119.22	
62																																	51	123.47	
63																																	24	133.13	
64																																	8	127.75	
65																																	1	104.50	
66																																	1	110.00	
67																																	1	110.00	
68																																	1	110.00	
69																																	1	110.00	
70																																	1	110.00	
71																																	1	110.00	
72																																	1	110.00	
Total Cases	1	23	62	111	173	214	255	239	216	180	128	78	59	25	18	7	10	1	8	4	4	2	3	1	1	1	1	1	1	1	1	1	1,823	107.57	











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